CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902

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Chem & Met

NEXT MONTH

As the National Defense Program gains momentum, the availability of technical man-power takes on increased importance. Construction companies are already beginning to feel the pinch and operating companies are very much aware of the possibility of personnel "bottlenecks" when the huge plants are finished. *Chem. & Met.* editors are busy this month gathering facts from both industrial and Government sources pertaining to this problem as it relates to chemical engineers or to jobs that might well be filled by men with chemical engineering training. They will present their findings next month in an eight-page report, "Chemical Man-Power for National Defense."

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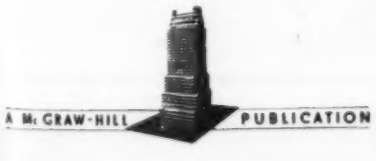

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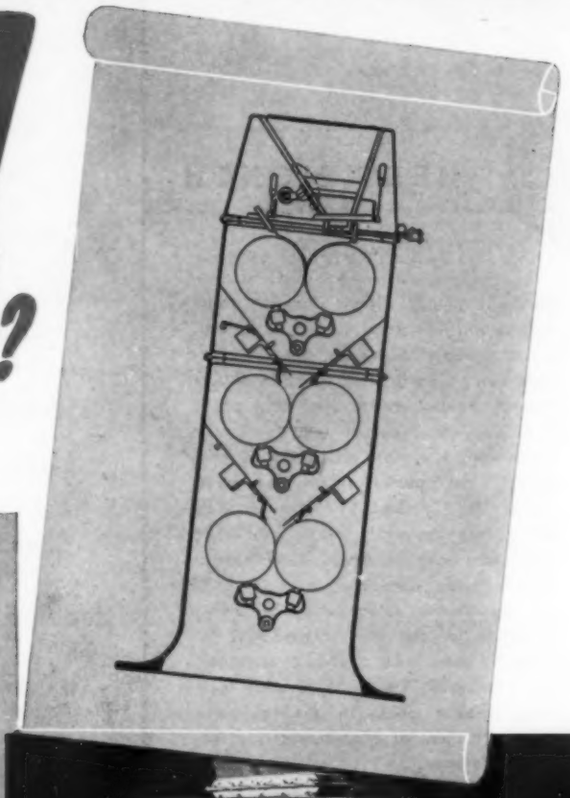

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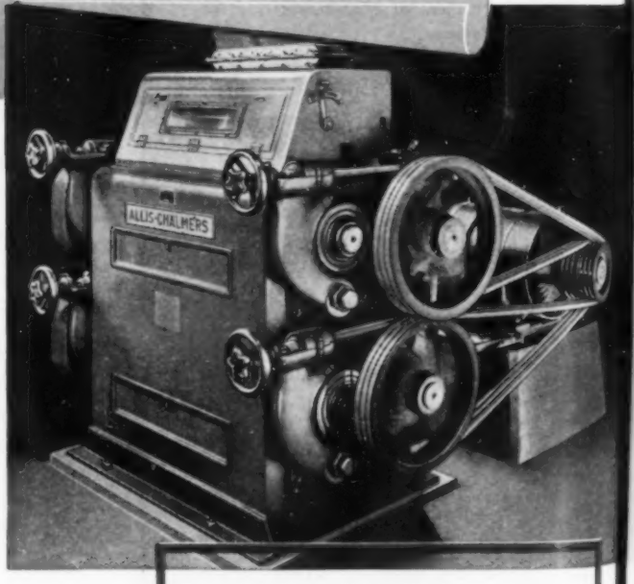

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CHEMICAL & METALLURGICAL ENGINEERING

ESTABLISHED 1902

DECEMBER, 1940

S. D. KIRKPATRICK, *Editor*

PREPAREDNESS FOR D-DAY

LATELY we have heard most about M-Day — that mysterious moment when, according to the Army's I.M.P. (Industrial Mobilization Plan), all of industry swings into the national defense program. In some respects we are already well past M-Day in this country. Military preparedness moves ahead far faster than in the early days of 1918. And it must continue to accelerate, taking precedence over all other immediate projects of manufacture and construction. Yet in this rapid short-range program, we should not entirely overlook the fact that some time in the indefinite future we are coming to D-Day. Industry is going to have to be De-mobilized (or perhaps Re-mobilized) for Peace. Company executives and research directors of farthest vision are already beginning to think and plan their remedies for the great post-emergency headache.

Consider a few of the problems chemical industries will face on and after D-Day. Governmental and privately expanded plants will have made available greatly enlarged supplies of ammonia, toluol, nitric acid and sulphuric acid — to mention but four of forty prominent chemicals in the defense program. Because of greatly increased capacity, improved technology and a large write-off of capital, the cost of these chemicals may be much lower than we have ever known before. It will not be surprising if ammonia could then be made ready for the market at less than two cents a pound, not including, of course, any sales or distribution expenses. Toluol might be made ready similarly at 15 cents a gallon — roughly half of the present price to the government. These are mere guesses. But they represent forecasts that should be no more unbelievable today than were the changes in chemical costs which occurred upon the conclusion of World War I.

For some commodities these conditions are going to mean that chemical materials will become available at prices that will permit their use in industries which hitherto thought them entirely out of reach for reasons of cost alone. The downward trend in prices will create many new opportunities for chemical engineering processes as well as new markets for their products. Thus the chemical process industries of America can look forward to future development on a much broader and more stable base.

All this presupposes a considerable amount of research and planning well in advance of D-Day. It will be well to get it started soon. Boards of directors must be sold on the idea that this is no time to economize on either technical or market studies. Even the men who are busiest on defense matters should be persuaded to give some thought to the post-emergency economic problems. We must be prepared for *Handelskriege* as well as *Blitzkriege*.

Our markets will be where we make them. Starting now, we should be able to create within the next few years entirely new types of activity both in this country and abroad. These may be concerned with the development of new products or with broader distribution of existing products. Or, in the field of production we may succeed to a greater extent in throwing off obsolete methods and equipment in order to establish higher efficiency and lower costs through radically new technology.

Those who plan and support research now on a greatly enlarged basis are the ones who in the end will be in the strongest position for permanent and useful service to their customers. Given the maximum of research effort, backed by greater engineering efficiency in production, and coupled with sound, aggressive promotion of new products and new markets, chemical industry need have no fear of D-Day.

FROM AN

SABOTAGE PRECAUTIONS

RECENT explosions, fires, and other accidents in chemical plants have created an unfortunate and unwarranted impression on the part of the public. There have also been certain complications within the staffs of the works where there have been such misfortunes. The suggestion of sabotage has been conspicious though altogether unwarranted during November. The Federal authorities have not been able to find a single case of this sort in chemical plants where sabotage seems even probable, much less likely.

Engineers and executives of chemical process industry have difficult and serious responsibilities in all such cases. First of all, they must protect life and property. Second, they must maintain the morale of their staffs. They have also large responsibility to their company ownership and stockholders for the protection of the reputation as well as the property entrusted to their care.

Generalizations are difficult on most aspects of these problems. There is obvious need for the greatest possible care to avoid accidents in the defense industries, especially when plants are being speeded up, perhaps even to supernormal capacities. Slightly greater output should not be sought when there is sacrifice of reasonable and necessary precautions. The plant personnel should be warned against excessive zeal, which becomes hazardous all too easily. And if there be unfortunate accidents the personnel should be helped to learn from the misfortune and be prevented from any indulgence in hysteria or even the milder forms of jitters.

Army, Navy, and other federal agencies will be glad to assist when their aid is needed. The Federal Bureau of Investigations has already provided a valuable booklet of "Suggestions for Protection of Industrial Facilities." That document is available in confidential form to the responsible head of any firm having contracts for defense materials. The FBI will go even farther in some cases. It will actually make a survey of a plant from the standpoint of prevention of sabotage and malicious damage. It is amazing what such outside help can uncover in the way of needed precautions that have been overlooked by those thoroughly acquainted with local situations.

In all these matters the chemical engineer has a primary responsibility. He must not overlook the necessity for every available precaution to maintain plant and personnel free from malicious hazard. But while he takes these precautions he must not allow himself or his operating staff to become nervous. Needless hurry and worry work for the fifth column as effectively as any willful felon.

DELINEATING DEFERMENT

MOST MISUNDERSTANDINGS of the selective service system center around the subject of occupational deferment (Class II). The important facts,—some of them well known, some not so well known—are as follows:

1. A man's classification is determined by the local Selective Service board for the community in which he lives and is based on his answers to an eight-page questionnaire which he will receive by mail.

2. There will be no job or industry deferment, each case being decided individually.

3. Class III registrants (those having dependents) will not even be considered for occupational deferment. In the average company, this represents about 50 per cent of the employees of draft age.

4. If an employee has no dependents, his employer may make a claim for his deferment but this claim must be made *within the five-day period* allowed the registrant to fill out his questionnaire.

5. If granted, occupational deferment is for six months only. It may be renewed for just cause, but eventually the registrant so deferred must serve if the life of the act is extended beyond the five-year period.

6. A registrant may appeal his classification, but he may not introduce any new evidence unless his status has changed since filling out his questionnaire. However, he may not make his appeal in person or be represented by counsel.

7. If a chemist or chemical engineer can show in his questionnaire that he has had the requisite training and experience, it is contemplated that he will be assigned to Ordnance or Chemical Warfare or some other branch where his services can be used most effectively.

EDITORIAL VIEWPOINT

Of the total number of employees who registered for the draft, 50 per cent will have dependents, which will grant them deferred status. Of the remainder, 20 per cent (10 per cent of the original number) will be rejected for service on physical grounds. From the rest (40 out of every 100) five will be called each year for the five years the act is in effect. Nevertheless it behooves every employer to be looking around for replacements or to begin training new personnel for the 5 per cent or so of vacancies to be expected each year.

BANKING ON RESEARCH

AT LONG LAST the bankers have begun to bank on research. At least that is the first impression one gets from the recent announcement of the Research Advisory Service, created through the voluntary cooperation of more than 800 industrial research laboratories to serve without charge the manufacturer-clients of a dozen of our leading banks. It is directed by Bert H. White, vice president of the Liberty Bank of Buffalo. Merrill Anderson, of the New York advertising agency that bears his name, is associate director and George Perazich, formerly of the WPA National Research project in Philadelphia, is its research engineer. A distinguished "Science Committee" is headed by Maurice Holland, director of the Division of Engineering and Industrial Research, National Research Council. With such a talented organization to lead the way, we can hope that finally the bankers are going to be guided to a true understanding of the value of research.

This may prove a long and difficult journey, however, and perhaps we should not be too critical of the first few faltering steps in that direction. Yet we cannot help but wish that the approach had been on something other than a "free-sample" basis. Here is the way the service operates according to the bulletin issued by one of the member banks and entitled: "Increasing Industry's Profits Through Research":

> If you would like this type of assistance on some problem of your own, the procedure is simple and it will incur no expense or obligation on your part. Reduce it to writing, giving all details that might be of help in working out the precise answer you want. Tell what steps you have taken and what sources you have contacted in your efforts to clear it up—so that others will not duplicate your work. Send this to the Bank, together with any samples which apply to the problem. This material will then be transmitted to one or more laboratories which have pledged their assistance. As soon as we have gathered information which we think will be of active interest to you, we shall forward it to you; it may come quickly, or it may require some time. Possibly it will come in the form of several preliminary reports before the final one, so that you will not have to wait for all your facts until the last worth-while channel has been explored.
>
> We hold all details of every problem in absolute confidence. The name of your company will be withheld from laboratories until we are satisfied that one laboratory has the correct answer; then release it only upon instructions from you. You need never divulge any of your trade secrets. It is, in other words, a case of much to gain, nothing to lose.

If we were a manufacturer-client of this well-known Midwestern bank and we really believed in Good Fairies, there might be a number of questions going through our mind right now. We might wonder why on earth we should have a research laboratory of our own,— why we should pad our payroll with a lot of chemists and engineers now that the bank is going to give us the benefit of more than 800 of the country's best laboratories. We might wonder, too, about the necessity for retaining consultants or sending our samples to that testing laboratory in New York, which charges $10 just for writing us a letter about them. No, there must be something wrong somewhere. And of course it couldn't be with the bank for we know it is nearly always right, especially on our monthly balances.

So it all comes back to the question of "who pays the bill?" The Research Advisory Service plainly states that it "does not compete with consulting engineers, chemists, testing laboratories or market consultants." It does not "undertake research work of its own but refers problems to laboratories in industry, universities, technical schools and trade associations which cooperate in the program." But surely the bankers must know that all this costs somebody some money. Could it be that some of us who pass out technical information so generously are being used by the banks to give their clients an entirely erroneous idea of the *cost* as well as the value of research?

We hope that this is not the case. We are dealing with too important a relationship to warrant any misrepresentations or misunderstandings. There are well informed men on the Science Committee or in the 800 cooperating laboratories who can help the Research Advisory Service in helping the bankers to sell research on a sounder basis. That is a more desirable objective than using free "research" as bait for any bank in its advertising and public relations program.

Chemical Activity in the Deep

JAMES A. LEE *Managing Editor, Chemical & Metallurgical Engineering*

Chem. & Met. INTERPRETATION

In order to give chemical engineers who attended the New Orleans meeting of the A.I.Ch.E. a background of the industrial development of the area around the Crescent City, Mr. Lee took them in his paper, which is reproduced in part here, on an imaginary trip from Corpus Christi on the west to Mobile on the east and to Dallas, Chattanooga and Birmingham on the north.—*Editors.*

NEW ORLEANS is the center of the "Deep South," an area along the Gulf Coast extending on the west to the Rio Grande, on the east to the Atlantic and on the north to Chattanooga, Memphis and Dallas, that is rich in attractions for the chemical process industries. Considering the vast market, the tremendously valuable natural resources that cannot be duplicated in any other section of the country, the enormous deposits of salt, sulphur, coal, natural gas, petroleum, lime, clay, glass sand, phosphate rock, and other materials, the adequate supply of cheap labor, power, water, excellent transportation facilities, a mild climate, tax and regulatory policies which for the most part have fostered the rational development of these raw materials, it is undeniable that no area offers greater opportunities to industry than does the Gulf Coast.

While there have been petroleum and sugar refineries, pulp and paper mills and a few scattered chemical plants for many years, the great migration of the industry to the Deep South has taken place within the past six or seven years. It may be considered to have commenced in 1934 with the announcement of plans for the Corpus Christi, Tex., plant of Southern Alkali Corp.

Most of the industrialization in the Deep South has developed around several cities as nuclei such as Corpus Christi, Houston, Baton Rouge, New Orleans, Mobile, Memphis, Chattanooga and Birmingham. A tour of these industrial centers would be enlightening to many engineers.

Corpus Christi—A beginning might be made in Corpus Christi, the western terminal of the Intracoastal Canal, an inland waterway extending through the principal cities along the coast to the Atlantic. The opening of the port in 1926 added to the attractions of the city which include extreme low-cost natural gas (it has been said, "At Corpus Christi is found the most economical fuel at tidewater in the United States"), deep water transportation, adequate railroad service, lime obtained from a plentiful supply of oyster shells, glass sand, salt, barytes and other mineral resources.

During the past few years many industries utilizing the agricultural products and mineral resources of the vicinity have been developed. There are 23 petroleum refineries, 25 cottonseed oil mills, three soap factories and one carbon black plant listed among the industries of "the fastest-growing city of the nation." The antimony smelter has the unique distinction of being the only plant of this type in the United States and one of two such plants on the Western Hemisphere.

Then, too, this is the home of the $6,000,000 ammonia-soda plant of Southern Alkali Corp. To this plant has recently been added a large installation of electrolytic cells at a cost of $2,000,000 to supply the rapidly developing market for chlorine created by the bleached sulphate pulp industry, water purification, organic solvents, and other chemicals. A market for the electrolytic caustic is found in the petroleum refineries and other industries. It was primarily the availability of natural gas at tidewater which brought this enterprise to Corpus Christi but, of course, the presence of salt and lime played their part.

Houston—Next on the itinerary is Houston, one of the great oil centers of the world. One of the refineries, Humble Oil & Refining Co. at Baytown, with a daily capacity of 140,000 bbl. of crude oil, is the largest in the United States and is being further enlarged by additional plant to cost $1,800,000. But of particular interest to chemical engineers is its development of processes for the conservation and utilization of light hydrocarbons. These developments are especially significant in that several units in the project are unique and in that all steps of the development have been made on an unprecedented scale. In addition to the above expansion program is a $12,500,000 plant that will be constructed and operated for the U. S. War Department. Toluol will be manufactured.

The Texas Co. at its Houston refinery is producing lubricating oils. The cold sulphuric acid alkylation and the small catalytic cracking units for making high octane aviation gasoline are new. Recently, additional furfural extraction and solvent dewaxing facilities were added.

In the vicinity of Houston are the mining operations of The Texas Gulf Sulphur Co., Freeport Sulphur Co., Duval Texas Sulphur Co., and the Jefferson Lake Sulphur Co., upon which the chemical industries of the United States depend to a large extent for their supplies of sulphur. Texas Gulf at Newgulf operates the largest sulphur mining plant in the world. The water treating plant is capable of softing and treating more than 30,000 tons of water a day and heating it to 325 deg. F.

In August one of Houston's oil companies, Shell, announced construction of a plant to make 2,000,000 gal. of toluol by its own process.

Another new addition to this city's industries is the Pittsburgh Plate Glass Co.'s plant which will make a full line of paints, varnishes and lacquers. The contract was recently let for this plant.

Houston boasts of three modern

Based on a paper entitled "Chemical Industries in the Deep South," presented before the New Orleans meeting of A.I.Ch.E., Dec. 2, 1940.

South

Plant of Ethyl Gasoline Corp. on the Mississippi River above Baton Rouge, La. Out of it comes tetraethyl lead anti-knock fluid

portland cement mills, South Texas Cotton Oil Co., Armour Fertilizer Works, Hayden Lime Co., Magnolia Air Co., Gas Products Co., Bemis Bros. Bag Co., Chipman Chemical Co., Southern Acid & Sulphur Co., and the Consolidated Chemical Co.'s plant producing fertilizer, sulphuric acid, bone carbon, hydrochloric acid, and other chemicals.

Just outside the city is the Pasadena sulphate pulp and paper mill of the Champion Paper & Fibre Co. which is one of the principal units in the recent expansion in the industry. Champion has taken a leading part in the development of bleached pulp from southern pines. In this connection the company installed a large number of electrolytic chlorine cells. And during the current year another forward step was taken with the construction of a paper mill to convert some of its pulp which previously had been shipped to the company's paper mills in Ohio and North Carolina. Champion's mills on the Houston Ship Channel represent an investment of $10,000,000.

South of Houston is Texas City, the home of refineries of Republic Oil Refining Co., Southport Petroleum Co. of Delaware, and Pan American Refining Corp. Pan American sometimes called "engineer's dream of an oil refinery" because of the fact that it was built from the ground up and utilizes most modern technology and equipment, is now building an aviation gasoline hydroforming plant. The process is said to yield a product of high octane number and high aromatic content.

To this group is being added a plant of the Carbide and Carbon Chemicals Corp.; construction started June 1. The purpose of the plant is to manufacture synthetic organic chemicals from refinery gases to be supplied by Pan American. This arrangement for obtaining raw materials is similar to that at the Whiting plant of the Chemicals corporation where gases are obtained from the adjacent refinery of Standard Oil Co. of Indiana. At the Texas City plant a variety of industrial chemicals will be produced.

At nearby Freeport, the Dow Chemical Co. purchased 800 acres of land in March and commenced construction of a $15,000,000 plant for the recovery of magnesium and other products from sea water, and Ethyl Dow is said to be duplicating its bromine plant near Wilmington, N. C., for the recovery of this material from sea water. It is understood plans included the construction of a 120-ton per day electrolytic cell plant to supply the chlorine used in liberating bromine from water.

Dallas—Dallas is to the Southwest what Atlanta is to the Southeast, an important center of distribution. However, the activity is not all distribution. There are several large and important manufacturing plants in Dallas. Procter & Gamble has had a cottonseed oil plant for some time and recently announced that a $1,000,000 soap products plant would be erected. The lack of a large soap plant in the South has caused considerable comment and amazement for some time. Perhaps other producers will follow P. & G. to this area which is such a large consumer of soap.

Newsprint from southern pines was made commercially in January, 1940, for the first time in this nation's history. The paper was the first to be produced in the Herty mill of the Southland Paper Mills near Lufkin. This project has attracted international attention because of its departure from standard practices and due to the tremendous influence that it may exert upon the future of the newsprint industry in our Eastern States and Canada. Partially bleached sulphate pulp from Champion's Pasadena mill is substituted for sulphite and mixed with the pine ground wood to form the sheet of newsprint.

Near the Louisiana line the traveller passes Beaumont and Port Arthur, locations of some of the world's largest petroleum refineries. The Magnolia Petroleum Corp. at the former city was one of the first to install and operate a Houdry cracking unit. It now has three of these units. This refinery also is operating a cold sulphuric acid alkylation unit. This Socony-Vacuum subsidiary has been among the most progressive in the industry.

The Gulf Oil Corp. at Port Arthur has recently disclosed that it is using the new polyform process. It illustrates the synthetic chemical aspect of petroleum refining. The process combines polymerization with cracking in a unique manner. It differs from thermal cracking in that oil is processed in admixture with normally gaseous hydrocarbons, particularly propane and butane, at higher temperatures and pressures.

On leaving Texas and travelling across Louisiana, one passes Mathieson Alkali Works' ammonia-soda plant at Lake Charles, which was built almost simultaneously with Southern Alkali's plant at Corpus Christi in 1934. Since the first of

this year Mathieson has announced plant expansion to cost $1,500,000. Under construction in the same city is the $4,000,000 refinery of the Continental Oil Co.

Then come the series of salt mines along the coast on Jefferson, Avery and Weeks Islands. On the last of these, the Bay Chemical Co. is converting the salt into hydrochloric acid, salt cake and other chemicals.

In North Louisiana are oil and natural gas fields, the carbon black industry and the pulp and paper mills. The pulp and paper mills are at Hodge, Monroe, Bastrop, Bogalusa and Springhill. The Gaylord Container Corp. has appropriated $5,000,000 for expansion of plant and equipment at its Bogalusa mill. The Springhill mill is the pride of the Southern Kraft Corp. It is the world's largest pulp mill and includes numerous innovations in the manufacturing processes. Important advances have been made in the bleaching of the pulp.

Baton Rouge—This city is well worth a stop-over for it is rapidly developing into an important chemical manufacturing center. In the early days activity was limited to the enormous refinery of the Standard Oil Company of Louisiana and to the sulphuric acid plant of the Consolidated Chemical Industries, but in the past few years not only has the Standard Oil invested many millions of dollars for the production of chemicals but other companies have erected large plants nearby.

This group of industries is of particular interest due to their close inter-relationship. The refinery was the first to arrive; it was followed by Consolidated which supplies its neighbor with sulphuric acid for the treatment of gasoline. Next came the Solvay Process Co. which invested $1,000,000 in an electrolytic cell plant and $7,000,000 in an ammonia-soda plant across the road from the refinery. Caustic soda is consumed in large volume for the refining of gasoline and chlorinated solvents are being used in increasing volume for the same purpose. More recently tetraethyl lead and metallic sodium plants were constructed by E. I. du Pont de Nemours & Co. for Ethyl Gasoline Corp. at a cost of $14,500,000. The original units were quickly followed by two additional ones. Standard Oil supplies the hydrocarbon for the ethyl chloride and Solvay the chlorine.

Early in the present year attention was again attracted to Baton Rouge by the announcement by the Standard Oil Development Co. that a new synthetic rubber plant would be built and operated in conjunction with the local refinery. The company has appropriated $1,000,000 for the production of the perbunan type which is made from butadiene and acrylic nitrile.

Other process industries which have come to Baton Rouge in recent years are the Compressed Industrial Gases and Bird & Son.

New Orleans—New Orleans commands a most advantageous position. The transportation facilities and rich mineral deposits, vast agricultural products, cheap labor and fuel, and climatic conditions combine to make the city unsurpassed as a location for all branches of the chemical industries.

For many years New Orleans has been a large producer of alcohol, cottonseed oil, refined sugar, heavy chemicals, fertilizers and other products; and recently to these have been added others, such as cement mills, printing ink, asphalt emulsion and roofing plants. But due to its greater size and metropolitan character new enterprises do not attract as great attention as they do elsewhere.

Just to the west of the city is the "sugar bowl" of Louisiana where almost all of the cane of continental United States is raised. This accounts for the sugar refineries of the American, Henderson, Godchaux and Colonial interest. And in turn the "black strap" molasses from these refineries account for the alcohol plants of the U. S. Industrial Alcohol Co., Commercial Solvents Corp., National Industrial Alcohol Co., American Commercial Alcohol Co., and others. To the sugar cane can also be traced the Celotex Co.'s wallboard plant for the bagasse of the cane becomes the raw material from which this product is made.

One of the most unique plants is that of the Freeport Sulphur Co. about 50 miles south of the city. For a description of this development see *Chem. & Met.* Vol. 40, p. 454 and Vol. 41, p. 406.

When finally leaving New Orleans behind the traveller soon enters the tung oil belt around Bogalusa, La., and Picayune, Miss. The young tung trees which have been planted in recent years cover the landscape in every direction as far as the eye can see. The nuts are brought to the plant at Picayune to be pressed. While there are still many problems to be solved, in the growing of the trees, encouraging yields are being obtained.

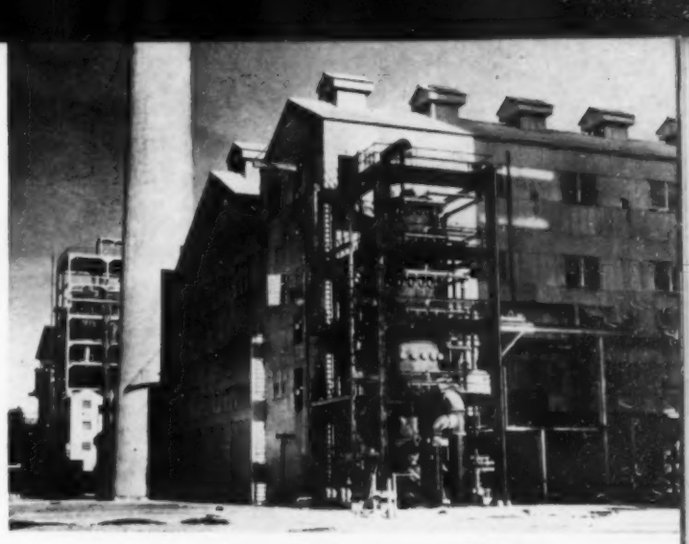
At Meridian is the plant of the Flintkote Co. This roofing plant will be completed in a few months. And at Natchez is the new plant of the Armstrong Tire & Rubber Co., which is being enlarged at the present time.

The next point of interest is at Hattiesburg, Miss. Here is one of the Hercules Powder Co.'s naval stores plants. The principal operation is the production of wood rosin, turpentine, and pine oil from pine stumps. This is one of the largest plants of its kind and produces the primary products upon the refinement and utilization of which much research and development work has been and is being done.

A few miles beyond is Laurel, the "100 per cent chemurgic city." Here are the Continental Rosin and Turpentine Co., the Laurel Starch Factory, and the Masonite Corp. It was here that the late William H. Mason conducted his experiments that led to the successful development of the process of exploding wood. While the chief products of the company to which he gave his name are fiber boards, it is now entering upon a program of making a low-priced plastic board and recovery as byproducts of the waste liquors of the main plant such chemicals as, furfural, acetic and formic acids, and other organic products. One of the more recent research developments is a new mode of making activated carbon from wood.

The U. S. Bureau of Chemistry and Soils has been endeavoring to develop a sweet potato starch industry in the United States.

Mobile—Mobile, Ala., is one of the most interesting of all the Gulf Coast cities. It is rapidly developing into one of the outstanding centers of the process industries and is likely to become much more important in the immediate future. Its excellent port, the Alabama State Docks, and the natural resources have attracted several large industries. The Southern Kraft Corp. has two pulp and paper mills located in the neighborhood on which $500,000 are now being spent for expansion; the Mobile Paper Co. is located here. The $5,000,000 white paper mill, known as the Chicasaw Mill, of the Hollingsworth & Whit-



At Lake Charles, La., is the ammonia-soda plant of the Mathieson Alkali Works. It has recently undergone expansion

Chicasaw white paper mill of the Hollingsworth and Whitney Co. at Mobile, Ala. This is the newest of the several paper mills in this city

ney Co., is starting operations as this is being written. These mills, which are large consumers of alum, were responsible for the American Cyanamid Co. building a plant in the city. The alum in solution is piped to the plants nearby.

But the pulp and paper is not the only process industry in Mobile. The National Gypsum Co. completed an insulating board mill two years ago at a cost of $2,000,000. The Alabama Naval Stores Co. has built a plant here for the production of pine oil, rosin, turpentine and related products. The Mobile Paint Manufacturing Co., the Ruberoid Co., and the Terminal Paper Bag Co. are new additions. Four oil companies have invested large sums of money in terminal facilities.

The Pan American Shell Corp. has completed its plant for crushing nuts from British Honduras. Shells are first removed by a freezing operation. The oil is refined and sold to the oleomargarine and soap industries. The shells are ground and used as synthetic resin filler or may be carbonized and activated.

In addition to these plants is the tremendously impressive alumina plant of the Aluminum Ore Co., which was described in *Chem. & Met.*, October, 1940.

It has been said of Tennessee that it is "an American Ruhr" in the making. Work is well under way on a $15,000,000 expansion program by the Aluminum Company of America at its Alcoa plant. Output will be doubled when expansion is completed.

The new plant of the Electro-Manganese Co. is part of an entirely new industry which uses electricity to process ores. Electro-Metallurgical Corp.'s first $1,000,000 unit at Muscle Shoals began operations this year. A $5,000,000 development is contemplated to expedite the production of ferro alloys and calcium carbide.

Last December, B. F. Goodrich started a new $1,500,000 plant at Clarksville. Production is increasing gradually. A $4,000,000 plant was established two years ago near Columbia by Monsanto Chemical Co. Phosphorus is produced by the electric furnace method. Monsanto has also begun to use a new process of producing manganese. A fourth electric furnace is to be installed. The Tennessee Eastman Corp.'s plant at Kingsport has recently undergone tremendous expansion. It produces a wide variety of materials, including acetate rayon and plastics.

In two years the Victor Chemical Co.'s plant at Mt. Pleasant has grown from a $1,000,000 one-furnace operation to a $3,000,000, three-furnace plant. Nashville is the location of the company's blast furnace phosphoric acid plant. The Tennessee Corp.'s plant is at Copperhill.

Memphis—At Memphis, Tenn., is the Forest Products Chemicals Co. This is probably one of the largest of the destructive wood distillation companies in the country.

The plant of the Buckeye Cotton Oil Co., a subsidiary of Procter & Gamble Co. is here. It is the largest cotton oil mill in the world, having a capacity of some 60,000 tons of seed. Adjoining this property is the plant of Cudahy Packing Co. which is devoted entirely to hydrogenating cottonseed oil.

Under construction just outside of the city is the $15,000,000 smokeless powder plant which the du Pont company will operate for the British Government. It is to be known as the Tennessee Powder Co. and is expected to be in operation shortly. Another Memphis industry is the Lehon Co., manufacturer of prepared roofing products.

Chattanooga is an industrial center that should be included in any account of the Deep South. The Southern Chemical Cotton Co. is a large producer of cotton linters for use in making rayon and explosives. Ceramics for use in the chemical industries are produced by the American Lava Corp. The Tennessee Products Corp. produces coke, and the O. B. Andrews Co., paper board specialties. The Burkart Schier Chemical Co. and the Southern Ferry Alloys Co., pioneer in the South, are among the other industries.

Birmingham—Birmingham, Ala., is "the Pittsburgh of the South." It is a wonderful combination of the natural resources, coal, and iron ore account for its steel industry. A few years ago $30,000,000 were added to the already enormous investment in steel mills. The Tennessee Coal, Iron and Railroad Co. constructed 73 coke ovens at a cost reported to be $2,000,000. Universal Atlas Portland Cement Co. invested $1,500,000 for addition to its mill. The Southern Cement Co. also has a mill in the city. The Birmingham Paper Co. manufactures corrugated paper boxes and containers and a variety of specialties. A few years ago the Virginia-Carolina Chemical Co. invested several million dollars in a lead chamber, sulphuric acid plant.

Thus we have travelled for miles, crisscross, back and forth from the Rio Grande Valley, north and east to Birmingham. Were there time and space to continue our journey we should find another interesting panorama unfolding around such centers as Charleston, Savannah, Brunswick, Jacksonville. But that must be saved for another trip.

Fatty Acid Panorama

GORDON W. McBRIDE, *Chemical Engineer, Washington, D. C.*

Chem. & Met. INTERPRETATION

Finding their way into hundreds of commodities from lubricants to foods, fatty acids and their derivatives are today more important industrially than ever before. Chemical engineering research has developed new uses and created new demands for these acids. It has also discovered sources of supply unknown ten years ago. Equally important, it is making this country less dependent on uncertain foreign supplies of fats and oils. Our over-all picture of these acids presents highlights of production and uses.—*Editors.*

ANIMAL, vegetable, or mineral?—The three kingdoms find a common meeting place in fatty acids. Industry today is offered fatty acids from a variety of sources, some of which were unknown or untapped a decade ago. No longer are the commonly used fats and oils the only sources. The petroleum industry and the paper industry, to name but two who were not in the market in 1930, are now actual or potential suppliers of fatty acids. Producers of ten years ago have felt the new competition, and have been stimulated both to develop new products and processes, and to improve their old products and find new uses for them.

Fatty acids, which may be built on order to almost any desired specifications, are serving as raw materials for many of the chemical process industries. The principal users of fats and oils have long known the essential characteristics and reactions of these materials with which they work. These are inherent properties of the constituent chemical molecules or radicals. In the soap field, for example, it is well known that lauric acid, the 12-carbon saturated acid derived principally from coconut oil, is essential in making a soap product which lathers well. The longer the chain of carbon atoms above 12, the less the lathering power. In the paint and varnish field the needed oils are those which contain large quantities of unsaturated fatty acids, such as linolic, linolenic, and elaeostearic. The edible fat and oil manufacturer has for over thirty years been aware of the importance of properly blended mixtures of saturated and unsaturated fatty acid glycerides in obtaining shortenings of desired consistency and keeping quality.

IMPORTANT USES

History undoubtedly substantiates the claim of soap as the earliest fatty acid derivative. In the chemical age of today there are many new fatty acid derivatives and their distribution through modern industry is wide and growing. The Twitchell reagents—themselves fatty acid derivatives—are in great measure responsible. With their development as active catalysts in fat splitting, the production of all fatty acids was given considerable acceleration. Mineral oil Twitchell reagents, developed more recently, have to some extent replaced the original animal and vegetable fatty acid types.

Sulphated and sulphonated fats and oils may also be classified among the earlier fatty acid derivatives. The peculiar oil and water solubility of these derivatives makes their use widespread in such industries as textile, paper, pharmaceutical, leather and soap. The fatty alcohol sulphates have appeared more recently and are finding immediate and enthusiastic acceptance.

Fatty acids as such are used in nearly all rubber products, acting as softening agents and aids in pigment dispersion. They also serve to provide lubrication in the milling of the rubber and to activate accelerators. Fatty acids are also used in the production of molded synthetic resins. Metallic soaps and stearic acid are those most commonly used, serving as mold lubricants.

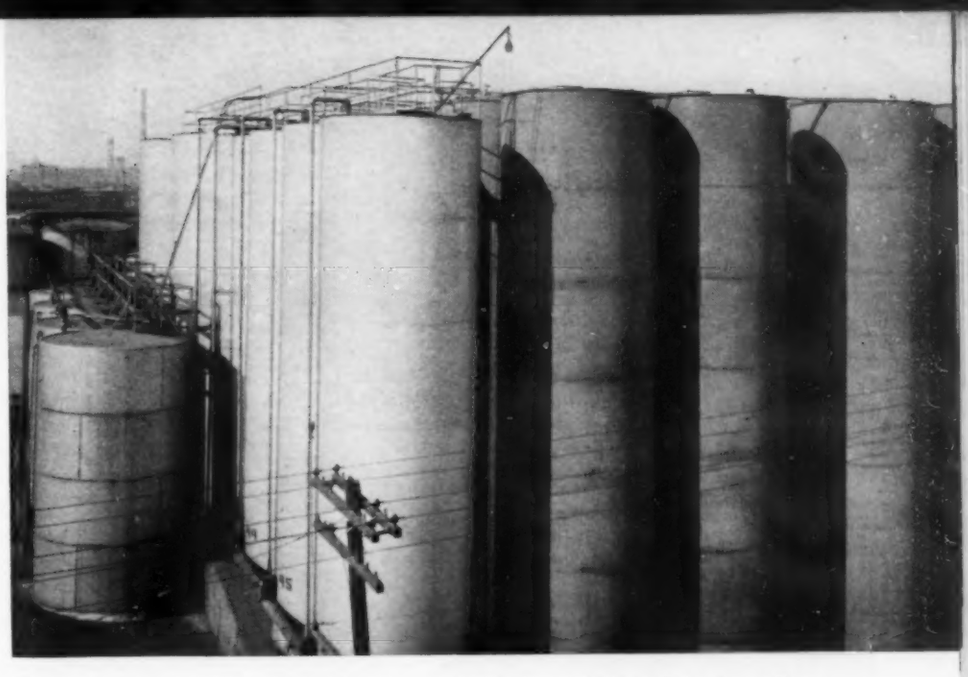
Fatty acids and derivatives are widely used in the petroleum industry. Primarily, they serve to im-

Table I—Fatty Acid Composition of Fats and Oils

These figures are approximations only, based on many experimental determinations reported in the literature. Individual samples of the fats and oils may vary from the figures shown

Fat or Oil	Saturated Acids								Unsaturated Acids			
	Caproic C_6	Caprylic C_8	Capric C_{10}	Lauric C_{12}	Myristic C_{14}	Palmitic C_{16}	Stearic C_{18}	Arachidic C_{20}	Oleic C_{18}- 2H	Linolic C_{18}- 4H	Linolenic C_{18}- 6H	Miscellaneous
Babassu oil	..	6	3	46	20	7	..	..	18	..	..	.....
Butter	2	1	2	4	10	28	10	1	35	4	..	3 (1)
Castor Oil	..	..	..	..	..	..	1	..	4	5	..	90 (2)
Coconut oil	1	9	8	45	20	8	3	..	5	1	..	.....
Cod-liver oil	..	..	..	..	4	10	1	..	..	..	..	85 (3)
Corn oil	..	..	..	..	..	7	4	..	46	43	..	.....
Cottonseed oil	..	..	..	..	1	21	2	..	30	46	..	.....
Lard	..	..	..	..	1	28	13	..	48	6	..	4 (4)
Linseed oil	..	..	..	..	..	4	5	..	7	49	35	.....
Menhaden oil	..	..	..	..	6	16	1	..	..	30	..	47 (5)
Oiticica oil	..	..	..	..	..	7	5	..	5	6	..	77 (6)
Olive oil	..	..	..	..	..	11	2	..	80	7	..	.....
Palm oil	..	..	..	..	1	40	5	..	46	8	..	.....
Palm kernel oil	1	3	5	50	15	8	2	..	15	1	..	.....
Peanut oil	..	..	..	..	..	8	3	3	61	22	..	3 (7)
Perilla oil	..	..	..	..	..	7	..	..	8	38	47	.....
Sesame oil	..	..	..	..	..	8	4	2	46	40	..	.....
Soybean oil	..	..	..	..	..	8	5	..	28	56	3	.....
Tallow	..	..	..	..	3	28	22	..	45	2	..	.....
Tung oil	..	..	..	..	..	4	1	..	10	2	..	83 (8)
Whale oil	..	..	..	..	6	13	1	..	25	20	..	35 (9)

(1) 3% Butyric (C_4)
(2) 90% Ricinoleic (12 - hydroxy-oleic)
(3) 14% C_{16}-2H; 28% C_{18}-3H; 28% C_{20}-5.5H; 15% C_{22}-7H
(4) 2% C_{16}-?H; 2% C_{16} and C_{22}-?H
(5) 16% C_{16}-?H; 19% C_{20}-10H; 12% Clupanodonic (C_{22}-10H)
(6) 77% Licanic (4 - keto-elaeostearic)
(7) 3% Behenic (C_{22})
(8) 83% Elaeostearic (C_{18}-6H)
(9) 17% Palmitolic (C_{16}-4H); 18% Clupanodonic (C_{22}-10H)



Steel storage tanks for vegetable and animal oils at the N. J. plant of the National Oil Products Co.

prove the metal-wetting qualities of lubricating oils and greases. They also serve as carrying agents for chlorine, phosphorus, sulphur, and other active elements used to inhibit corrosion, and to enhance oxidation resistance, load-carrying capacity, and wear resistance. The thickening effect of metallic soaps in lubricating greases is also well known and is the basis of extensive manufacture.

Food uses of fatty acid derivatives are not numerous compared with the wide variety of inedible fatty acid applications. However, such compounds as mono- and di-glycerides of stearic and laurie acids are found in many food products. They are not naturally occurring compounds, though they are closely related to the natural fats and oils. Use in bread, cake, ice cream, salad dressings and food fats is typical of their wide application. They are so used because of their emulsifying, thickening, texture improving, and homogenizing properties.

Not long ago, these fatty acid derivatives were laboratory curiosities. Now many companies advertise the mono- and di-glycerides. Glycol fatty acid esters are also on the market, as are the simple paraffin fatty acid esters.

PRODUCT DEVELOPMENT

When fatty acids were first produced, the products were comparatively crude. As specialty uses were developed, demand increased for refined fatty acids. The synthetic resin industry can claim responsibility at least in part for the resulting progress. It was necessary in the production of certain high-grade synthetic resins to have fatty acids of very light color and good keeping quality. These have been achieved by many manufacturers. Low pressure distillation in stills built of corrosion resistant metals and the use of stabilizers have given a big boost to the efficient production of the paint and varnish type of resin.

For the past ten years economic competition has forced—and rewarded—many rigorous programs of fundamental research. Manufacturers of fats and oils products have examined their products critically, one at a time. They have asked themselves the questions, "Because of what fundamental property is this product used?"; "Can its effectiveness be increased by concentrating some essential ingredient?"; "By what more economical method could the desired result be achieved?" Having posed such questions as these, the next step was to investigate all possible sources of the desired constituent. Then there had to be considered the form in which it might most effectively be made, sold and used.

For example, as is well known, ordinary soap is fundamentally the sodium salt of a fatty acid. It is usually made by reacting a fat with caustic soda, and the byproduct glycerine is recovered from the soap kettle. This traditional batch method is being challenged, however, by two distinctly different processes. One of these involves oil saponification on a continuous basis, with the alkali concentration adjusted properly to give anhydrous soap and, by flash distillation in a vacuum chamber, the glycerine as by-product. The chief advantages of this process are the recovery of relatively pure concentrated glycerine and the saving of freight on the 6 or 8 per cent water which is ordinarily in industrial powdered soaps.

By the other new process of soap manufacture, the desired soap oils are first continuously hydrolyzed to fatty acids and glycerine. Then the resulting mixed fatty acid is continuously neutralized to form a conventional soap. This process is applicable to almost any of the usual variety of soaps now available on the market. Neutralization of this fatty acid might also, if desired, produce an anhydrous soap as in the first process described.

As previously mentioned, the soap manufacturer knows that the sodium salt of laurie acid is the desired rapid-lathering constituent of his soap product. Coconut oil has been for many years and still is the most readily available *economic* source of this fatty acid. However, that oil must be imported; and the supply is subject not only to possible interruption in time of international conflict, but also to political regulation in peace time. Although there is no natural domestic substitute for coconut oil, it is at present subjected to an excise tax which materially increases its cost to all American soap manufacturers.

With modern chemical research and technology many methods have been proposed to make synthetic fatty acids. By cooperation between the domestic soap and petroleum industries a synthetic coconut oil fatty acid has been developed that compares favorably with the natural product. It has not replaced coconut oil in the soap industry because it cannot compete at normal price levels. However, it puts a ceiling on the price of coconut oil and can be made if conditions should warrant it at any time.

PROPERTIES MADE TO ORDER

Much work has been done recently to modify domestically-produced vegetable oils to obtain various desired properties. The research being carried on at the Regional Soybean Laboratory of the U. S. Department of Agriculture to make a drying oil from soybean oil is an excellent illustration. The fractional distillation of fatty acids, split from domestic fats and oils, has also been recently brought into production. By this method concentrations of any desired fraction may be obtained for use as fatty acids and their deriva-

tives, or may be re-esterified back to a wanted fat or oil.

Methods of separation of the component fatty acids of natural fats and oils are also being studied from the standpoint of crystalization and of solvent selective separation. Physical chemistry and thermodynamics have contributed their share to this phase of the development. Recent patents on solvent treatment of oils to separate the unsaturated components from the saturated foreshadow a domestic drying oil supply.

Hydrogenation of unsaturated edible oils to control consistency and keeping quality is a well-known modification of the fatty acid end of the oil molecule. Similar treatment converts unsaturated inedible oils to ones suitable for soap stock. Hydrogenation may also be used to reduce fatty acids to alcohols. This is the source of raw material for sulphated fatty alcohols and may provide an extremely important basis for organic synthetics.

FATTY ACID SOURCES

A long-important source of fatty acids is the meat-packing industry. Those portions of an animal which cannot be processed to yield edible products are usually cooked to free the fat which they contain. This grease or tallow goes principally into the soap industry. However, it also serves as a raw material for specialty products. Sulphated tallows are an outstanding example. The water-insoluble soaps (calcium, magnesium and aluminum salts of the fatty acids) are also of great importance. In addition to the use of the insoluble soaps because of their lubricating properties, they are used in cosmetics as face powders, in paints and lacquers as dulling agents and as waterproofing agents. An interesting new use was recently reported for them in the paper industry. This was based on their ability to lower surface tension in certain emulsions, making them valuable as defoaming compounds in pulp beaters.

Outstanding in the fatty acid developments of recent years is the adaptation of castor oil to the drying oil industry. Dehydrated castor oil, a replacement for tung oil, is produced by removing water of constitution from the oil molecule. It represents the first entirely new drying oil not found in nature. It thereby differs from the fractionated fatty acid or the solvent separated synthetic drying oils which are actually only the component parts of natural fats and oils.

The import of castor beans into this country from South America has been tremendously accelerated in the past few years. With the growth in popularity of this old crop, increased domestic production has been urged. Experimental plantings have been tried in many regions throughout the Southern States. It is possible that the castor plant may reach significant production in this country in the near future.

An outstanding new source of fatty acids which has been developed in the past decade is the pulp and paper industry. These fatty acids, variously known as tall oil and liquid rosin, are of growing importance. Their properties have been examined in detail and found to compare favorably with more costly raw materials. The principal uses so far have been in low cost and specialty soaps. Metal cleaners and polishes also have been made from tall oil and a wide variety of other specialty uses is claimed. The refined tall oil is recommended for uses similar to those of red oil or oleic acid. Although the total production is small at present, it is abundant in prospect. Large scale use is expected as efficient methods for fractionating the component acids are developed. With a content of approximately 25 or 30 per cent abietic acid, tall oil should prove to be a very popular raw material for the soap industry in the manufacture of yellow laundry soap. At least six companies are known to have been producing tall oil in the United States. Since it comes from waste liquor in the sulphate process, the base raw material cost is negligible. Recent research has indicated possibilities for their use in modified alkyd resins and in synthetic drying oils. Even edible products are a possibility. In any case, tall oil serves as a very cheap source of vegetable fatty acids, a comparatively untapped reservoir of formerly discarded waste products.

Table II—Analyses of samples of dehydrated castor oil have shown approximately the following composition:

Saturated acids	2%
Hydroxy acids	7%
Oleic acid	9%
Linolic acids	
9, 11 conjugated	21%
9, 12 normal	61%

These analyses were made by the Woburn Degreasing Co., one of the leading manufacturers of dehydrated castor oil. (Stoichiometric comparison should not be made with the analyses of unprocessed castor oil shown in Table I.)

Equipment used for extraction of vitamins from fish-liver oils. The process is carried out under an atmosphere of nitrogen

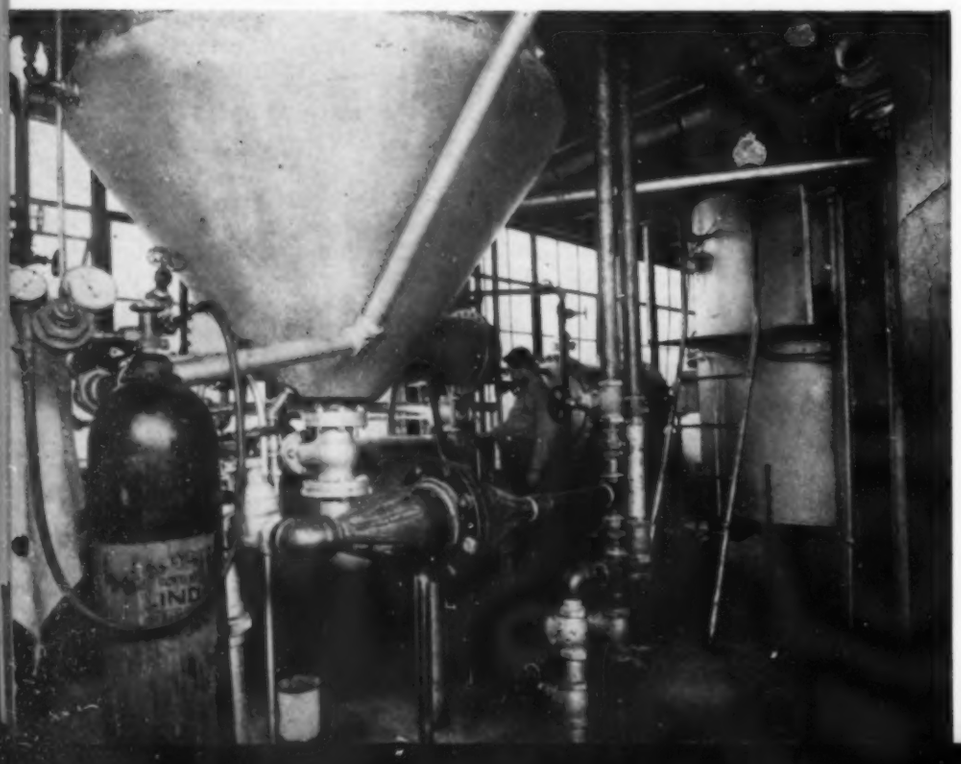
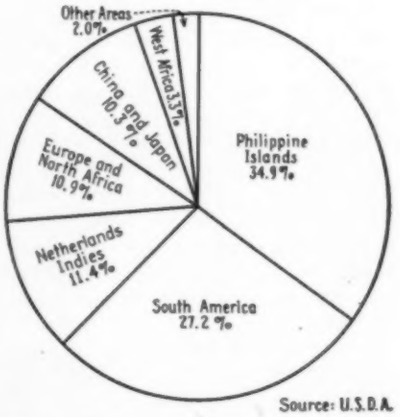


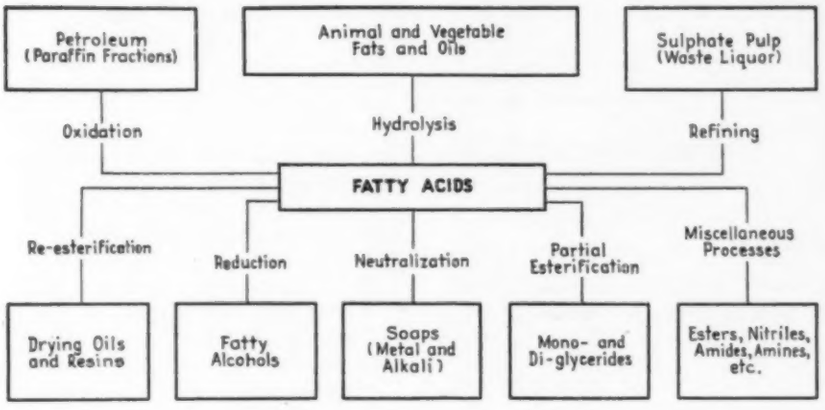
Fig. 1 — U. S. imports of fats and oils for the year beginning July, 1938

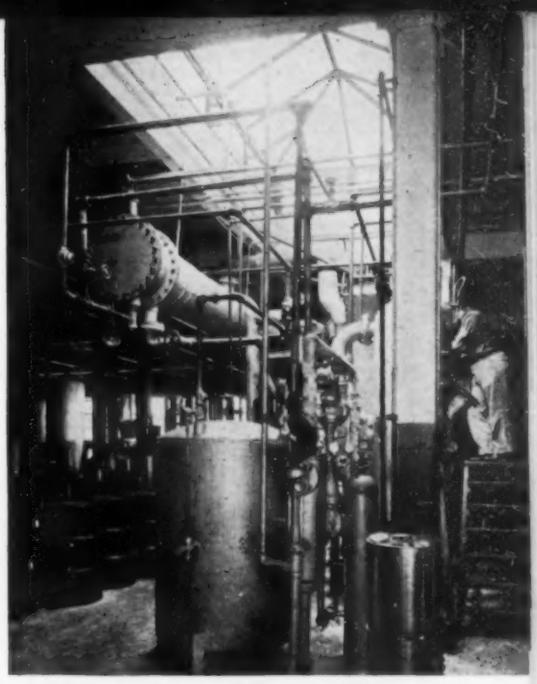


Source: U.S.D.A.

Total imports were 1,906,385,000 lb. Although imported fats and oils represent only 20-25 per cent of U. S. consumption, it would be difficult to get along without them.

Fig. 2—Relationship of fatty acids to their sources and their major uses. This chart shows some of the more important relationships developing as fatty acids become more widely available commercially





Fatty acids are removed from fish oil in the equipment shown above

In a minor way, waxes also contribute to the fatty acid picture. They are the source of some common fatty acids and of many not so common, cerotic acid from carnauba wax, for example. Of course, no glycerine is recovered from a wax, but the higher alcohols which are recovered may be even more desirable than glycerine.

Synthetic waxes are also available and widely used. Here again is an example of man improving upon nature. When natural waxes are analyzed for structural details, the explanation of their properties is usually revealed. By applying a little fundamental organic chemistry, synthetic products can be built up commercially with properties similar to the natural wax. Slight or even major variations can easily be achieved by suitable modification of the molecular structure.

NEW PROCESSES AND PRODUCTS

The chemical engineer has contributed to the fatty acid availability in many ways. Not the least among these is the development of continuous processes by which fats and oils may be split into their constituent fatty acids. Such processes insure products of uniform quality, and usually of better quality than can be obtained by the ordinary batch production methods. The fact that higher concentrations of glycerine are obtained in continuous splitting processes makes them no less attractive economically.

Synthetic glycerine is also a factor in the fatty acid situation. Although very little is being made at present, the mere fact that it can be made very efficiently serves as a helpful stabilizing influence on the entire fatty acid industry. By establishing a ceiling on the price of glycerine, the processor of fats and oils is encouraged to obtain the maximum possible value from the fatty acid end of the molecule. This is a significant factor in stimulating the development of new fatty acid specialties.

Antiseptics, drugs, and dyes are being prepared containing fatty chains. In antiseptics and drugs, toxicity is lowered and solubilities changed. In dyes, oil and resin solubility is promoted.

The preparation of fatty acid amines has been an important recent development. These compounds are formed by hydrogenating easily made nitriles and when soluble, are alkaline in raction. A salt of one of these compounds, dodecyl amine acetate, has shown itself to be very effective in clarification of turbid water. Detergent and emulsifying properties are reported for the amines in general, and uses as bactericides and insecticides have been proven. Other nitrogen derivatives, such as the amides and nitriles, are also being used as emulsifiers, wetting agents, lubricants, stabilizers, flotation reagents, etc. The amides in particular are changing the entire field of textile finishing, by giving cloth with permanent softness, desirable feel, and water repellency.

Certain mercury derivatives of fatty acids have been shown to have weed-killing properties. Apparently they selectively attack the root structure of certain types of weeds in preference to grass roots which may be completely intermingled.

Recent publicity has been given to polymerized acylated styrenes, indenes, and coumarones. Claims are made for their resinous properties and their use in varnish or lacquer bases is suggested. They also exhibit properties essential to a pour-point depressor for mineral oil lubricants.

Sulphonated arylstearic acids (oleic acid derivatives) are used as fat splitting reagents; and sodium salts of these acids may be used as emulsifying agents and penetrants. Other arylstearic compounds are also in increasingly widespread use in lubricants and as intermediates in organic synthesis.

Some of the alkyd resins, used principally in paints, varnishes and lacquers, are outstanding examples of modern fatty acid derivatives. They are the esters of polyhydric alcohols and polybasic acids, modified with an oil or a fatty acid. One of these, a soybean or castor oil modified glyceryl phthalate resin, has recently been announced in England as a reagent which makes fabrics both transparent and impermeable to fluids. The new process is reported to improve the feel and life of the fabrics. Silks and rayon are the principal fabrics so treated, but a similar process can also be used on cotton.

There are many details of fatty acid technology which deserve elaboration. However, in such a review as this, only the high spots can be touched. The panorama has served its purpose if it has shown the importance of fatty acids to industry, and the relationship of the fatty acids with each other. Judging from present research activity, they will be increasingly important raw materials in chemical process industry of the future.

Synthetic Glycerine From Petroleum

E. C. WILLIAMS and ASSOCIATES *Research Laboratories, Shell Development Co., Emeryville, Calif.*

Chem. & Met. INTERPRETATION

Long awaited, the remarkable story of the development of Shell's synthetic glycerine process can at last be told. It is not a 100 per cent disclosure of the unique process, but it is enough to outline some of the difficult problems encountered and show the fundamental principles involved in their solution. Some eminent chemical engineers have termed the development of this process the most significant chemical achievement since the fixation of atmospheric nitrogen by the Germans in 1915. But be that as it may, the process, coming at this time of renewed international conflict and involving, as it does, one of our basic explosives raw materials, presents a striking likeness to Haber's great achievement of World War I. It is an accomplishment in which Shell's chemists and engineers can, and do, take just pride.—*Editors.*

RECOGNITION of new and increasing industrial uses of glycerine, coupled with observation of the wide fluctuations in price of this basic chemical product, led us in 1936 to consider the possibilities of synthetic manufacture.

The world supply of glycerine under normal conditions is obtained as a byproduct from processes of hydrolysis or saponification of natural oils and fats, with the single exception of the efforts made during and following the last World War to produce it by fermentation.

One would suppose that such a typical byproduct from a comparatively stable industry, finding its main outlet in other reasonably stable industries, would be maintained at a reasonably steady price level. This, however, has not been the case. It seemed to us also that development of new industrial uses, especially those involving more complicated and expensive manufacturing processes, would be obstructed or not started at all unless the price of the initial base material could be stabilized.

Preliminary studies showed that the supply and demand of natural glycerine were already sufficiently close together to justify the belief that future years might, under certain circumstances, show an actual shortage of glycerine—a shortage which would come earlier if either glycerine supply should decline, as, for example, through expansion in use of synthetic soaps, or consumption substantially increase. Feeling, as we did, that the very fact of stabilization of glycerine prices at a low level might tend to increase the uses of glycerine beyond the capacity of the soap industry to supply, it appeared that the time was ripe to consider the possibilities of synthetic production. The time for actual commercial production on a large scale has not yet arrived, but we are ready when it does come. A pilot plant with substantial tonnage capacity per year has been in satisfactory operation for some time.

The commercial synthesis of glycerine has been the goal of many research workers. As far back as 1856 Bertholet and deLuca regenerated it from tri-bromopropane (itself prepared from glycerine) by treatment with moist silver oxide. From that year to this innumerable investigations have been made but only one process has yielded a commercial glycerine.

During the last war Germany produced 13,000 tons per year of glycerine made by fermentation, a process that has received considerable attention and is well known. The process is essentially a modification of the ordinary alcohol fermentation in which by control of pH by the addition of suitable salts, the amount of glycerine formed is increased. Commercial difficulties attending this process are concerned chiefly with the rectification to high grade glycerine at an economic cost. It is further necessary to tie in with production of a considerable amount of alcohol.

Recently, part of a series of patents has appeared assigned to E. I. duPont de Nemours & Co., which discloses a new synthesis of glycerine with carbon monoxide and hydrogen as the ultimate starting materials (U. S. Patent Nos. 2,211,625 and 2,211,626). This process involves the condensation of carbon monoxide with formaldehyde to give glycolic acid, reaction of this with a formal, and ultimately the alcoholysis of a formaldehyde derivative of glycerine.

Of the numerous syntheses possible, however, the most direct are those starting with the three carbon skeleton. This is particularly apropos when petroleum is to be made the ultimate starting material, since unlimited amounts of propylene and propane are available from this source. Even when these limitations are made the possible syntheses are legion, as is readily discernible from the reaction diagram, page 836. Thousands of investigations were necessary to determine which one might have the best commercial possibilities. We finally chose a line of synthesis starting with propylene and proceeding to allyl chloride to allyl alcohol (or to glycerine dichlorohydrin) to glycerine. The step-by-step development of this process will be described in the following paragraphs in the order of the compounds mentioned. However, we should like to emphasize at the outset that the discovery of the "hot chlorination" of propylene made the process feasible. Also, a larger-scale plant might not use the allyl alcohol step.

Propylene

At the temperature used for chlorination of the propylene, propane is chlorinated rapidly to propyl chlorides which cannot be separated readily from allyl chloride by distillation. Hence, it is necessary to start with as pure a propylene as possible. A second reason for a pure feed is to avoid wastage of chlorine

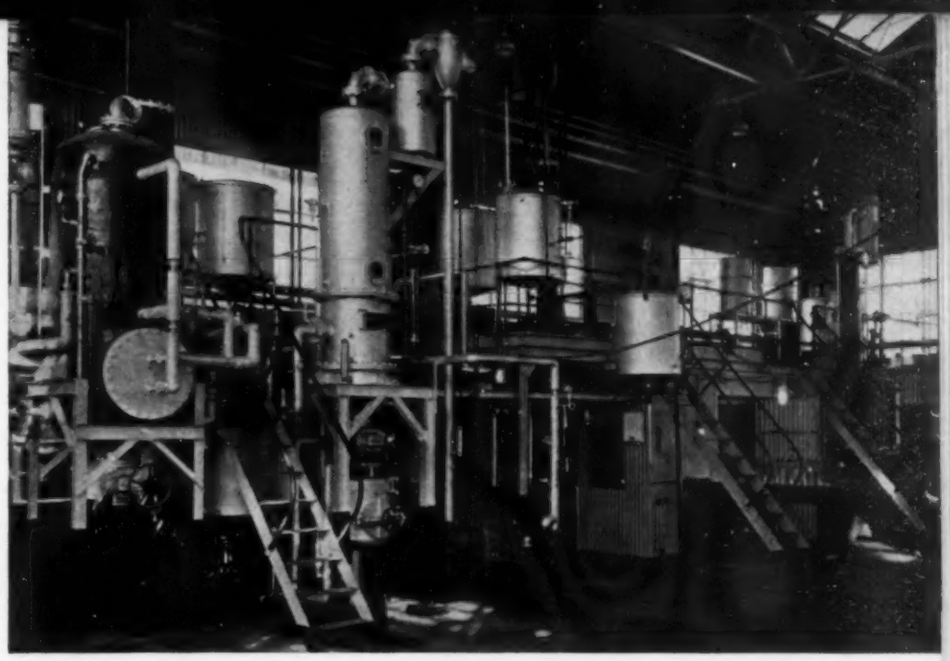
Based on a paper of the same title presented before the New Orleans meeting of the American Institute of Chemical Engineers, December 3, 1940.

in unwanted byproducts. Propylene of 98 per cent purity is satisfactory for all ordinary purposes. This can be obtained by rectification of refinery cracked gases, but for the pilot plant work it was prepared from isopropyl alcohol by dehydration over alumina in the ordinary manner.

Allyl Chloride

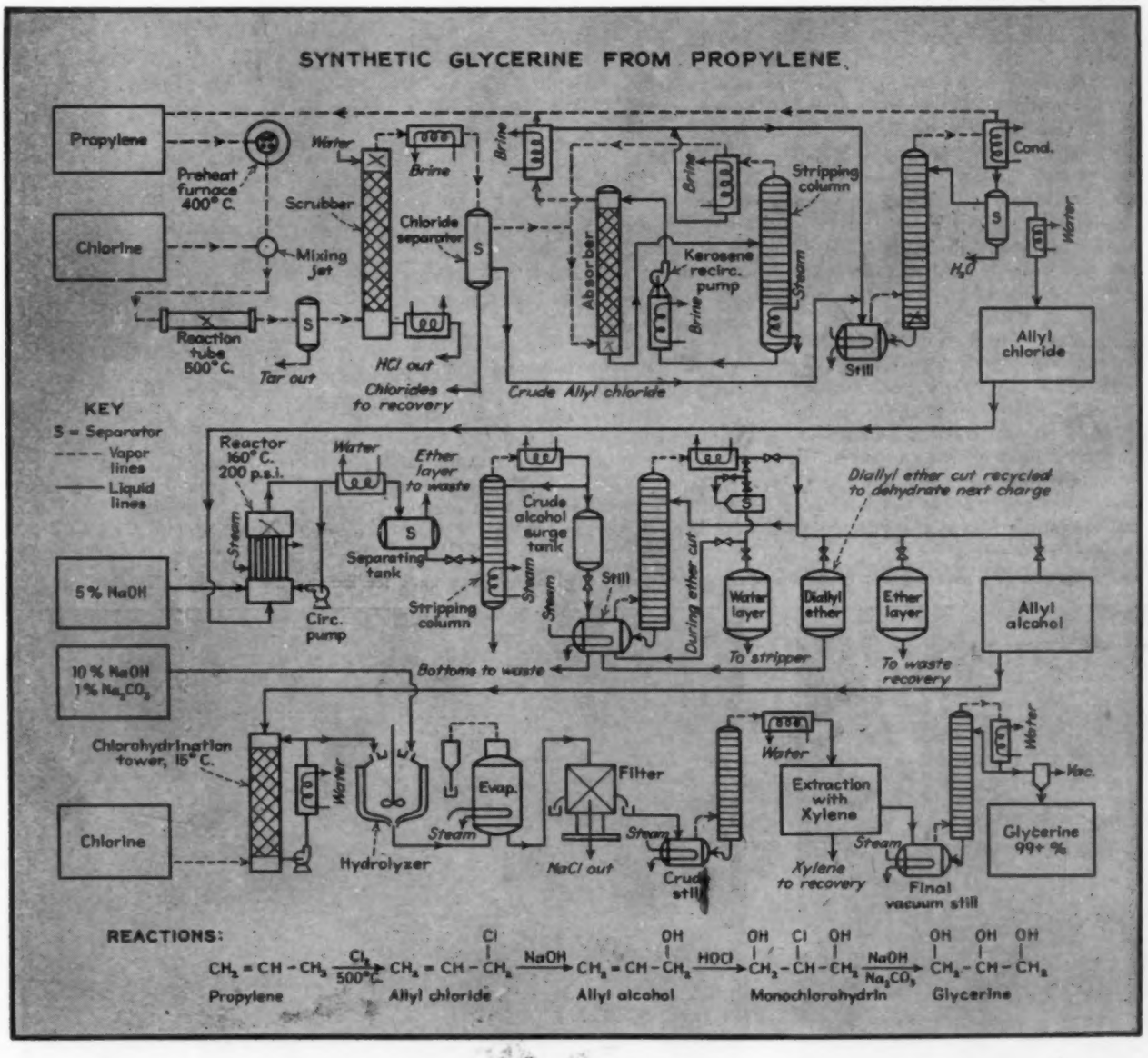
Propylene may be reacted with chlorine to give propylene dichloride (1, 2 dichloropropane) by a simple addition reaction. This compound may then be converted to allyl chloride in either of two ways. U. S. Patent 1,477,047 claims 66 per cent conversion to allyl chloride by passing the dichloride over calcium chloride at 350 deg. C. but our investigations denied this possibility and uncovered other disadvantages.

Attention was directed next to



General view of the semi-commercial glycerine plant of the Shell Development Co., Emeryville, Calif. Here the last step in the manufacture of synthetic glycerine from petroleum is performed. The principal operations in the unique process, divided into three distinct steps, are shown in the flow sheet below

Flow sheet prepared by Chem. & Met. editors.



straight pyrolysis of the dichloride (U. S. Patent No. 2,207,193 assigned to Shell Development Co.). Though satisfactory for making allyl chloride, it has certain disadvantages and could not be considered a happy solution to the problem.

Consequently, we next turned our attention to the direct chlorination of propylene to allyl chloride without an intermediate product. Ordinary chlorination results, of course, in addition at the double bond with the formation of propylene dichloride as described above. But arising from similar work done in our laboratories on butylene, it was discovered that at elevated temperatures (500 deg. C.) chlorination resulted in the direct attack of the methyl group with the consequent formation of allyl chloride in yield of the order of 85 per cent.

$$CH_2{=}CH{-}CH_3 \xrightarrow{500^\circ C.} CH_2{=}CH{-}CH_2Cl$$

This is the "hot chlorination" process mentioned above. It was described in detail by Groll and Hearne in 1939 (*Ind. Eng. Chem.*, **31**, 1530).

Pilot Plant Work—Having a successful laboratory scale process for allyl chloride, the next problem concerning this first step in the glycerine synthesis was pilot plant development.

As finally worked out the 2,000 lb. per day pilot plant produces allyl chloride as shown in the upper part of the accompanying flow sheet.

Control of chlorination reaction around 500 deg. C. is maintained by preheating the propylene to about 400 deg. C., then introducing the chlorine into an efficient mixing jet. The heat of the reaction, which is almost instantaneous, is allowed to raise the temperature of the reactants to 500-530 deg. C. at which temperature best yields of allyl chloride are obtained.

This method of bringing the reactants to the desired operating temperature has been entirely successful, much superior to mixing the reactants cold and then heating, or to preheating both reactants separately and then mixing. The former procedure leads to the formation, by chlorine addition, of much dichloropropane, while the latter leads to uncontrollable reactions accompanied by considerable carbon deposition and frequently inflammation.

The actual reaction, initiated immediately after the mixing, takes place in a simple steel tube which is insulated sufficiently to allow the reaction temperature to rise to the desired level.

Both the ease of temperature control and the avoidance of overchlorination of di- and trichlorides are benefited by feeding a large excess of propylene over the theoretical amount required for reaction with the chlorine. Increasing the propylene ratio from 3.0 to 5.0 led to an increase in allyl chloride formation from 66 per cent to about 80 per cent of theoretical. Also, within the range of this test the increase was linear. Limitations of the plant recovery system prevented experimentation at higher ratios and cost of the recovery system leads to an economic compromise in the commercial plant.

The type and efficiency of the mixing jet for propylene and chlorine also plays a large part in the formation of higher chlorides. Satisfactory results were obtained with the type described by Chilton and Genereaux (*Trans.* A.I.Ch.E., **25**, 102 (1930)). The time of residence in the reaction zone is not too critical, provided sufficient time is allowed for completion of the reaction.

We have experienced no difficulties from corrosion at any point in the reactor equipment. No particular care is taken to dry either chlorine or propylene; indeed, the latter is fed to the plant from a water-sealed gas holder.

The vapors leaving the reactor consist of unchanged propylene, unsaturated monochlorides, unsaturated and saturated dichlorides together with small amounts of higher boiling chlorinated hydrocarbons and HCl. These products are separated and recovered individually by suitable processes of extraction and rectification. The HCl may be recovered either anhydrous or as aqueous commercial acid. Several organic solvents are applicable for the absorption of the chloride vapors; we have used kerosene in our plant.

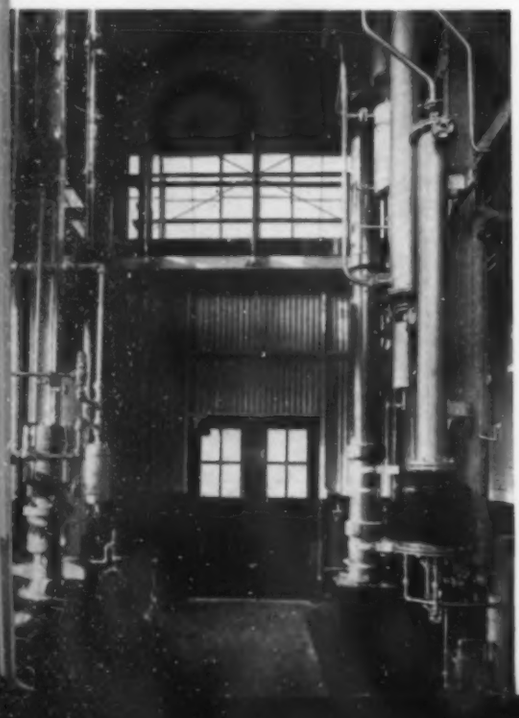
Allyl Alcohol

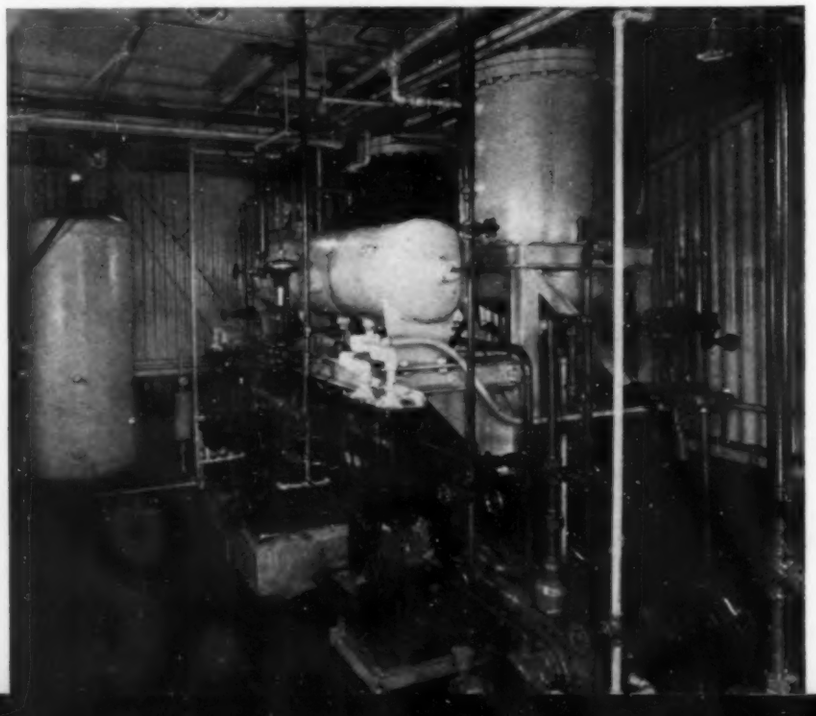
Second step in the synthesis of glycerine is the hydrolysis of allyl chloride to allyl alcohol.

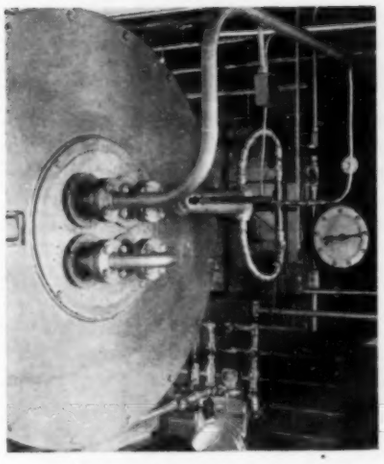
Actually we can synthesize glycerine without going to allyl alcohol at all. As shown on the previously mentioned reaction chart there are at least two alternative routes. Allyl chloride may be further chlorinated to trichloropropane quite easily. Hydrolysis of the trichloride to glycerine, however, proved a serious obstacle and this line of synthesis was abandoned.

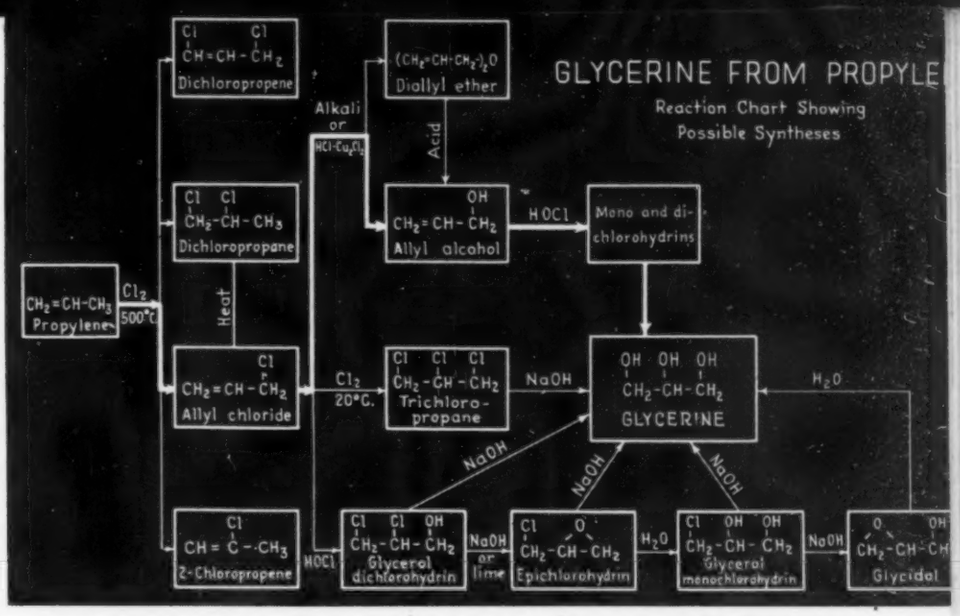
The second alternate process, direct chlorohydrination followed by hydrolysis, merited more serious consideration. Several workers have studied the chlorohydrination of allyl chloride, but insufficient data have existed to evaluate the process ac-

Allyl chloride recovery unit (left) and automatically controlled hydrolyzing units for making Shell's allyl alcohol (right)









At left is the preheat furnace in the unit for high-temperature chlorination of propylene. Allyl chloride is the product

curately. It obviously requires considerably different conditions from the chlorohydrination of allyl alcohol since the alcohol is water soluble and the chloride substantially insoluble. To keep undesirable byproducts at a minimum the reaction is best carried out in the aqueous phase. Also contact between unreacted material and gaseous chlorine is to be avoided because chlorine tends to dissolve preferentially in the non-aqueous phase, again giving undesirable byproducts. In view of these considerations, chlorine is best supplied by a solution of HOCl and NaCl, formed by reacting chlorine gas with NaOH. Glycerine dichlorohydrin is readily recovered by extraction followed by distillation. Yields of the order of 91 to 95 per cent were recorded. The dichlorohydrin could then be hydrolyzed with caustic soda or with part caustic soda and part lime (refer to reaction chart; not shown on flow sheet).

These reactions are, after prolonged pilot plant work, now considered preferable to the synthesis via allyl alcohol. However, since allyl alcohol is an important product in its own right, the hydrolysis step was investigated in both alkaline and acid solutions with satisfactory results (U. S. Patent 2,072,016). For the alkaline hydrolysis it was found that better results are secured when using carbonate than when using free sodium hydroxide, a result dependent primarily on the difference in pH of the two reagents.

Carbonate is, however, somewhat inconvenient to use in practice because very high pressures can develop when the evolved CO_2 is not vented. If the CO_2 is vented, volatile material is carried off with it and the pH also rises. To obtain the convenience of NaOH and the high yields obtainable under controlled pH, recourse was had to charging the autoclave with water, allyl chloride and a small amount of sodium carbonate. The mixture was heated and stirred and the pH measured constantly by means of sealed-in electrodes. As the reaction progressed NaOH was forced into the autoclave at a rate sufficient to maintain the pH at 8-11. In this way yields of 90 to 95 per cent were obtained. The accompanying table compares these results with those obtained by catalytic hydrolysis, using cuprous chloride as a catalyst.

Hydrolysis of Allyl Chloride

Hydrolyzing Agent	Alkaline 12% Na_2CO_3	Acid 2.8% HCl, 0.2% Cu_2Cl_2
Temperature, deg. C.	150	80
Yield, based on allyl chloride, per cent		
Allyl alcohol	94.7	85
Diallyl ether	1.6	9
Unreacted chloride and loss	3.7	6

Alcohol Pilot Plant — As shown above once allyl chloride is secured, the preferred routes to glycerine are either hydrolysis to allyl alcohol followed by chlorohydrination and hydrolysis, or direct chlorohydrination of the allyl chloride with subsequent hydrolysis. Both routes have been investigated on pilot plant scale.

The first concern in making allyl alcohol was to make the process continuous. After investigating several reaction schemes, the arrangement for alkaline hydrolysis shown in the second part of the flow sheet was adopted. As the drawing shows, the hydrolyzer consists of a tubular vessel, the hot solution recirculating so that hydrolysis takes place at somewhere near exit conditions.

As is usually the case, the variables controlling this reaction are more or less inter-related. The most important are temperature, concentration and pH of the solution. The temperature was fixed rather arbitrarily at 150 to 160 deg. C. This temperature is reached easily, gives a good reaction rate, and permits the use of moderate pressures (200 lb. per sq.in.). The question of concentration is somewhat more complicated. The higher the concentration, the greater the loss to diallyl ether, as the following figures show:

Normality	Deg. C.	Composition of Products Alcohol	Ether	Unreacted
2.5	158	82.5	11.5	6.0
1.25	157	87.5	7.6	4.9
0.625	158	93.7	3.0	3.3

Hence from this standpoint the most dilute solutions give the best yields, but this eventually is offset by the increased difficulty in recovery from these solutions. Furthermore, concentration has another effect on reaction velocity. The more dilute the solution, the faster the reaction, but of course less material is produced per unit volume. However, when both factors are taken into account, it is found that the maximum production rate per unit volume occurs at a concentration at about 1.25N, i.e., corresponding to 5 per cent NaOH as the hydrolyzing medium.

Alkalinity has a fairly pronounced effect on the ratio of allyl alcohol to ether formed from allyl chloride. Thus decreasing the alkalinity from sodium hydroxide to sodium bicarbonate causes a 30 per cent reduction in ether formation. Consequently, for highest efficiency, this variable as well as concentration and temperature should be closely controlled. The absolute importance of this feature, however, is not great, since even with crude control the conversion to ether can be held to below 10 per cent.

Representative data for the system

shown in the flow sheet are given in the accompanying table. The results compare favorably with small-scale experiments and by operating at lower concentration the yield can be improved easily. Nickel is the recommended material of construction, but care should be taken that there are no overhead pockets in the system in which allyl chloride can collect. If allyl chloride does collect, it immediately starts hydrolyzing, local acidity develops and corrosion ensues.

Hydrolysis of Allyl Chloride

	1	2
Temperature, deg. C.	156	155
Allyl chloride rate, lb./hr.	23.5	22.4
Caustic rate, gal./hr.	28.0	27.3
Caustic strength, per cent NaOH	5	5
Time, hours	12.8	235
Total allyl chloride fed, lb.	301.5	5,261.0
Balance on allyl chloride, per cent		
Allyl alcohol	88.3	87.2
Allyl ether	8.8	9.4
Unreacted	1.1	0.0
High boiling and loss	1.8	3.4

If anhydrous allyl alcohol is desired, the constant boiling mixture is dehydrated by azeotropic distillation using diallyl ether as the entraining agent.

Glycerine

The ease of allyl alcohol production established, attention was turned next to converting it to glycerine. Direct addition of chlorine to the anhydrous alcohol to give glycerine dichlorohydrin in good yield has never been very successful with other workers, and our attempts over a wide range of conditions brought no great additional hope.

On the other hand, chlorohydrination in aqueous solution proceeds readily. In the first run a simple procedure was employed in which chlorine was bubbled into the well-stirred aqueous alchol at 20-25 deg. C. until reaction was complete, the resulting solution neutralized and then hydrolyzed for 30 min. at 150 deg. C. with 3 per cent excess sodium bicarbonate. The glycerine was then recovered by neutralizing the hydrolysate, boiling down the solution, filtering out the salt (which was washed with isopropyl alcohol to recover any glycerine), and finally vacuum distilling the glycerine. Blank experiments starting with glycerine mono and dichlorohydrins gave 96 per cent yield of glycerine by this procedure.

A series of runs was made in this fashion in which the only variable was the concentration of the initial aqueous allyl alcohol. The yield increases in almost a straight line relation as the concentration of allyl alcohol decreases until the highest yield, 92 per cent, is reached in the 5 per cent solution. Incidentally, at this concentration the product of chlorohydrination is nearly all glycerine monochlorohydrin, with very little dichlorohydrin.

CONTINUOUS OPERATION

While this procedure was simple, it was not too well adapted to large-scale continuous operation. One of the difficulties to be anticipated here was the problem of heat removal, since the reaction is highly exothermic. This matter was satisfactorily solved by use of a tower reactor, with recirculation of part of the product through a cooler. In operation the tower was kept filled with a gaseous chlorine as the continuous phase, while the aqueous solution descended over the packing. This arrangement functioned quite smoothly, and the temperature could be maintained easily at 15 deg. C. In this way, typical results were:—

Concentration of allyl alcohol in feed.	4.4%
Volume product recycled per volume of feed	2
Temperature	14 deg. C.
Balance of products on allyl alcohol feed	
Unreacted	1.5%
Glycerine	93.5
Heavy ends	3.5
Total accounted for	98.5

It still remained to make the hydrolysis to glycerine a continuous process. This was accomplished by simultaneously feeding the unneutralized chlorohydrin solution and an aqueous alkali containing 10 per cent NaOH and 1 per cent Na_2CO_3 to a small stirred autoclave that was kept liquid full. Product was withdrawn at the same rate as the feed, passed through an unstirred, heated vessel to complete the reaction, and then removed from the system. The maintenance of accurate alkalinity conditions, times of contact, and temperature, are important here.

Under suitably chosen conditions, typical balance on allyl alcohol is: unreacted 2 per cent, glyerine 89.5 per cent, heavy ends 4.5, and total accounted for 96.0 per cent. Deviations from optimum operating conditions lead to loss of yield due to by-product formation, and loss of quality due to greater difficulty of purification.

PURIFICATION

It is not sufficient, however, merely to prepare glycerine; it is also essential that the glycerine produced satisfy the most stringent commercial specifications for this product. The minimum acceptable specifications are those of the U. S. Pharmacopeia. In the early part of our work we produced some rather remarkable glycerines. They came in a wide variety of colors—yellow, brown, green, red—and odors—burned, caramel, pineapple, gingerbread, and even some hitherto undescribed and indescribable smells. Fortunately, we have lost the secret of making these compounds and now produce, what is to all intents and purposes, the simple chemical entity 1,2,3-trihydroxypropane. Working out the details of the purification process was a rather tedious job, for a whole week elapsed from the start of the chlorohydrination step to the isolation of finished glycerine. However, as a result of continued experience and methodical elimination of all unfavorable conditions a procedure was developed which has been entirely satisfactory.

The glycerine hydrolysate is concentrated in much the same way as soap glycerine lyes, and then vacuum distilled. This leads to a crude glycerine which does not yet meet commercial specifications. However, by making appropriate cuts during the distillation, extracting with a solvent such as xylene (U. S. Patent 2,154,930), and redistilling, a glycerine is secured which meets all commercial specifications.

90 PER CENT YIELD

The ultimate overall yield of finished glycerine from allyl alcohol or allyl chloride is about 90 per cent, while a typical glycerine analyzed as follows:

Color (Pt-Co)	0–5 (practically 0)
Chlorine	0.00 (2) %
Acids and esters	0.0002 (6) equiv./100 gm.
Density 20/4	1.2611
Readily carbonizable substances (U.S.P.)	Straw color (passes)
Taste	Sweet
Odor	Not detectable

Material of this quality, so far as we have been able to ascertain, meets all commercial specifications and is equal to or better than any glycerine offered in the market.

Glycerine Pilot Plant — We regret that at the present writing the details of pilot plant operation for this last step in the glycerine synthesis cannot be disclosed. This decision was forced upon us by the fact that so much of the economic operation of an economic glycerine process depends on precise engineering and operational techniques, disclosure of which at this time would be contrary to the national interest. We hope that this last step may be discussed in greater detail at some future more opportune time.

[*In presenting this paper, high tribute was paid by Dr. Williams to his associates in this work—particularly to: T. W. Evans, G. H. Van de Griendt, W. Engs, W. E. Vaughan, R. W. Millar and L. M. Peters.—Ed.*]

Rôle of Chamber Sulphuric Acid In Manufacture of Munitions

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Chem. & Met. INTERPRETATION

Chamber process sulphuric acid is too weak for use in manufacture of munitions without concentration. Therefore, if sufficient contact acid is available, chamber acid is not likely to be used for this purpose. A simple means of employing the output of chamber plants and at the same time enormously increasing the capacity for strong acid made in contact plants is to use chamber acid instead of water as make-up for contact plant absorption acid.—*Editors.*

SULPHURIC ACID made by the chamber process is usually produced and marketed as 60 deg. Bé. acid, containing 77.67 per cent of H_2SO_4. At brimstone burning plants, acid up to 62 deg. Bé., containing 81.30 per cent H_2SO_4, can be produced by means of the usual chamber plant equipment. How can these grades of acid be used in the manufacture of munitions, which require acid of much higher concentration for their production?

During the first World War chamber plant acid in large quantities was concentrated to 66 deg. Bé. and even to 97 per cent H_2SO_4 by means of heat concentrators, fired with coke, coal, oil or gas. The same procedure can be employed today. However, the modern steam-heated, vacuum-type concentrators are much more economical. In certain cases, where a chamber plant is reasonably close to a contact plant, the best way to concentrate the product of the former to 66 deg. Bé. or higher strengths is to fortify it with the product of the latter.

The product of a contact process plant is primarily sulphur trioxide, a gas, which is transformed into sulphuric acid by the subsequent step of combining the sulphur trioxide with water. This combination is usually effected in an indirect manner, namely, by absorbing the sulphur trioxide in concentrated sulphuric acid containing approximately 98 per cent H_2SO_4.

The absorption of only a small proportion of sulphur trioxide in 98 per cent sulphuric acid serves to bring the concentration of the acid to, say, 100 per cent, and in order to restore the concentration to 98 per cent for the purpose of continuing efficiently the absorption of sulphur trioxide by recirculation of the same body of acid, the 100 per cent acid must be diluted. This dilution may be performed with water, or with relatively dilute sulphuric acid.

Practically all contact plants produce, in addition to the main product of highly concentrated sulphuric acid or oleum, more or less relatively dilute sulphuric acid as a byproduct. At brimstone-burning plants this byproduct acid is obtained from the air drying or gas drying towers, which are fed usually with 66 deg. Bé. acid, the latter becoming more or less diluted by the absorption of moisture from the air or gas to be dried. At ore-burning plants, the relatively weak byproduct may be derived from flue drainings, gas drying towers, Cottrell mist precipitators, gas filters, etc. Whatever the source, it is customary, at contact plants, to utilize all such weak acid, if sufficiently pure, for diluting the 100 per cent acid to the desired absorption strength of approximately 98 per cent H_2SO_4. Because of the practice of cleaning ore gas by washing it with water or very dilute acid for the removal of impurities which are not present in brimstone gas, it is natural that the ore-burning plant should produce much more dilute acid than the brimstone-burning plant, where the burner gas can avoid water saturation at the low temperature that would result from a water wash.

At ore-burning contact plants it often happens that enough clean dilute acid is produced in the plant itself to completely satisfy the plant's own demand for weak acid for diluting purposes. On the other hand, at brimstone-burning plants, the production of weak acid is usually insufficient for diluting all of the 100 per cent product, and then it becomes necessary to supply the deficiency, either by adding water to the 100 per cent acid, or by adding relatively dilute sulphuric acid obtained from some extraneous source.

The latter is the more economical of the two courses of procedure. And the usual extraneous source of acid for diluting purposes is a neighboring chamber plant, where 60 deg. Bé. acid, or sometimes 62 deg. Bé. can be secured. By using 60 or 62 deg. Bé. chamber acid for diluting purposes, instead of water, the daily output of the contact plant, in tons of 66 deg. Bé. or 98 per cent acid, can be enormously increased. The stronger the diluting acid, the greater will be the daily output of the contact plant in tons of highly concentrated acid. On the other hand, the greater the introduction of unnecessary water into the product of the contact plant (as by carelessly permitting rain or washings to get into tanks, acid lines or other equipment, the smaller will be the quantity of diluting acid that can be used, and hence, the smaller will be the daily output.

The accompanying table illustrates for a contact plant producing 108 tons of sulphur trioxide daily, the extent to which the daily output of strong acid can be increased by diluting with sulphuric acid instead of with water. The tabulation is based on a water condensation within the plant of 110 lb. of H_2O, per ton of SO_3 produced.

Daily Output of Strong Acid for a Contact Plant Making 108 Tons of Sulphur Trioxide per Day, Using Various Strengths of Diluting Acid

Diluting Medium	Per Cent SO_3 Contained	Daily Acid Output as		Per Cent Increase Over Water Dilution	
		98 Per Cent, Tons	66 Deg. Bé., Tons	Shipping as 98 Per Cent	Shipping as 66 Deg. Bé.
Water	None	135	142	.....	.....
50 deg. Bé. acid	50.76	172	198	27.4	39.4
60 deg. Bé. acid	63.40	215	283	59.2	99.5
62 deg. Bé. acid	66.37	237	334	75.5	135.0

Applying Water Pumping Equipment To Process Pumping Problems

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Chem. & Met. INTERPRETATION

This is the third and last of a group of articles dealing with water for process industry use and with pumping. The earlier articles, in September and October, dealt with water supply problems, particularly as relates to quality and quantity of available supplies; and to the newer types of pumping equipment that have been developed to raise water economically from the low levels now often encountered. The present article shows how the newer centrifugal types are being used today in equipping pumping installations other than for water. As the author points out, improvements are such that it is no longer safe to assume that a new installation need only duplicate an existing one.—*Editors.*

EXPERIENCE in water supply pumping brought about the development of efficient, low cost equipment. As was demonstrated in the two preceding articles in this series (see *Chem. & Met.*, p. 622, Sept. 1940 and p. 680, Oct. 1940), this equipment is adequate to solve difficult and unusual industrial water supply problems, as well as those more generally encountered. Also, having won its spurs in water supply the same equipment, with perhaps slight modification, has in recent years been found useful in overcoming difficulties and saving pumping costs in other process industry pumping problems.

Characteristics of these modern pump designs that cause them to find acceptance for process pumping work are good performance under varying requirements, low cost of maintenance, self-priming operation, small space requirements, and suitability for installation in locations where interference with plant working space is avoided.

An example of the deep well turbine pump employed for handling liquids other than water occurs in the pumping of natural brines. This method of pumping brine wells is used by many chemical companies and salt producing concerns.

For instance, an especially complicated application is used at the plant of Westvaco Chlorine Products Co. Here natural brines are pumped from a depth of 700 ft., from 18 wells. These wells are equipped with deep well turbine pumps delivering from 25 to 90 gal. per minute. The depth of these wells requires the use of special steels in shafting and other pump parts. A further complication arises in that the wells give off natural gas mixed with the brine.

AVOIDING GAS BINDING

To overcome trouble from the gas, each pump is equipped with electric controls which cut it out of service when the impeller becomes pocketed with gas. A time delay relay then holds the unit out of service until the pump can completely reverse itself. This requires about 15 minutes, after which the unit is automatically cut back into service.

Another type of brine well application that is less difficult occurs in wells where hot water is introduced into shafts drilled into salt deposits in order to melt the salt so that it can be brought to the surface. In these wells, the head is relatively less because the column of fresh water introduced into the well holds the saturated brine high up in the well.

Inside the plant, deep well turbine pumps in short settings, or other types of vertical pumps, can often be used to advantage in work that was formerly always done with horizontal pumps. Such applications are, in general, similar to that in the accompanying sketch, Fig. 1. The suction and discharge lines are on the same level, the pump forming one leg of a U-bend. This keeps the pump always primed and free from air pocketing, enabling it to handle liquids carrying small amounts of air or gas without seriously affecting pump operation.

In Fig. 1, the pump is shown installed in a dry pit, beneath the level of the plant floor. Such a setting is suitable for many installations, and is necessary where the suction and discharge lines must be installed at or near floor level. However, in many cases the piping can be installed at or near the ceiling. This has the advantage of keeping the floor clear of pipelines. When this is done, the pump can be installed along a wall, out of the way, and driven from a vertical motor placed above, or by belt, from a motor placed in some other convenient location.

Vertical pumps installed in this manner can be used for handling any liquid that can be pumped with a centrifugal pump. For pumping water or oil around the plant, boosting to high level tanks, or serving processing equipment, this general type of vertical pump installation is coming more and more into use, especially where high pressure, steady flow and freedom from suction troubles are desired. Among the useful applications of vertical pumps is that as a standby pump for fire protection service.

A special case of the application of the vertical turbine pump is found in the use of such a pump as a portable transfer pump. An example is the case where a multi-stage deep well turbine pump in a close-coupled mounting is installed on a tripod frame provided with casters

so that it can be readily moved from place to place. It is equipped with quick-disconnect hose fittings, so that it needs no permanent piping. While this type of pump was primarily developed for the transfer of liquids from one car, tank or barge to another, it can be used for many other purposes such as pressuring filters, circulating liquids, supplying cooling liquids to coils, and for tank agitation.

Advantages of such a pump are its small space requirements, mobility, freedom from priming and air pocketing difficulties, and the postion of the motor, high up and safe from splashing.

MIXING APPLICATIONS

An application of the low-lift propeller or mixed-flow type of vertical pump is indicated in Fig. 2. This shows a group of propeller pumps used for circulation in a sugar carbonator installation. Here the motors are mounted above the carbonation tanks, out of the way, and drive the pumps through extended vertical shafts that pass directly down through the center of the carbonators. The pumps are set directly upon the circulating main below the tanks. A gate valve in the suction connection permits regulation of the flow.

Pump installations of this sort can be used for other purposes besides circulation of liquids. For example, for paint-mixing tanks. When agitation is required, the pump shaft may be left uncovered and agitator blades can be fasteneed directly to it. Such an installation can be used to empty the tanks by reversing the direction of rotation of the impeller.

SPACE SAVING

Before passing from a consideration of the industrial utility of the vertical pumps originally designed for water service, it is worthwhile to stress again the space saving feature of this equipment in water service. Because these pumps are mounted in a vertical position, with the motor either directly above or directly below the pump the floor space requirement is held to a minimum. And when the submersible type of motor is used, the water supply can be located beneath an aisle, driveway or street, with no sacrifice of working space at all. This advantage has become particularly important with the extended use of air conditioning systems, which often require an independent supply of cool well water for cooling purposes, to lessen the refrigerating load, to avoid the installation of expensive cooling towers or spray ponds, or because the relatively large air conditioning water requirement cannot be filled from other sources of water supply.

One of the industries which makes good use of vertical pumps is the pulp and paper industry. In addition to using this equipment for supplying the large quantities of water required in pulp and paper manufacture, vertical pumps are also used for such process work as the handling of paper machine stock. For instance, Beckett Paper Co., Hamilton, Ohio, uses vertical pumps for this purpose, as shown in Fig. 3. This is one of several pumps that handle stock ranging from 0.5 to 0.6 fiber content. This material has a tendency to come through the pump in long shreds, which eventually ball up and tend to clog the pump impeller. The difficulty has been overcome through the use of two-port totally inclosed impellers with very wide openings. With this design, impeller clogging is avoided.

Another process industry where vertical pumps are finding considerable application for process liquid handling is the petroleum industry. For quick unloading of crude oil or fuel oil from tankers to barges or shore, deep well turbine pumps are being installed directly on the boats, with the motors above decks and the pumps submerged in the oil compartments of the tanker's hold. This has proved to be an economical and safe unloading method.

SUBMERGED MOTORS

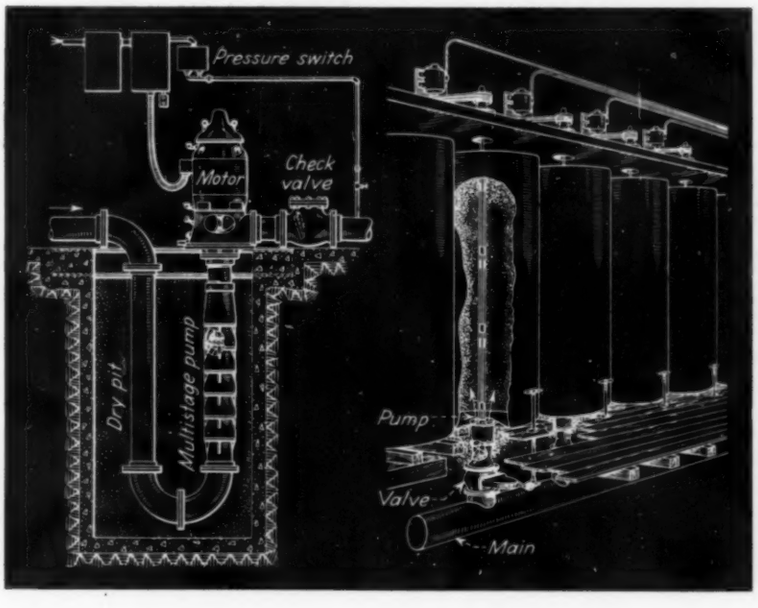
In refinery operation and also in handling such refinery products as gasoline and butane, the vertical pump is finding wide application. For use where the service is hazardous, some pump designers have brought out special pumps, in which the motor is submerged in an isolating liquid, so that fire or explosion hazard is minimized.

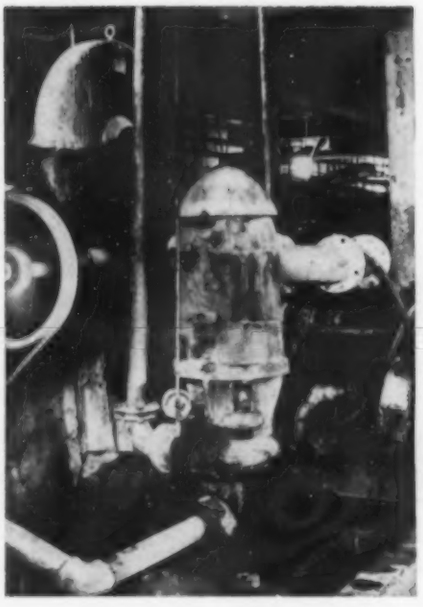
In pumps of this type the motor, below the pump, and the pump itself are inserted in a heavy cylindrical barrel and suspended from the flanged barrel cover. (A cross-sectional drawing of this pump appeared on p. 491 of our August 1940 issue.—Editor.) The motor runs in oil and a mercury seal prevents the pumped liquid from entering the motor. The lower part of the barrel, surrounding the submersible motor, is filled with an isolating liquid that is immiscible with the liquid being pumped. This prevents the possibility of the motor igniting any flammable liquid that the pump handles. The liquid enters a suction nozzle at the top of the barrel and floats on the isolating liquid. Pump discharge is through the top of the barrel.

An example of the use of such a pump is found at the plant of the Union Oil Co. at Wilmington, Calif.,

Fig. 1. Left—Vertical, close-coupled Pomona turbine pump installed in a dry pit for pressure boosting on water supply or handling of process liquids

Fig. 2. Right—Propeller type Pomona vertical pumps installed for circulating contents of a line of sugar carbonating tanks





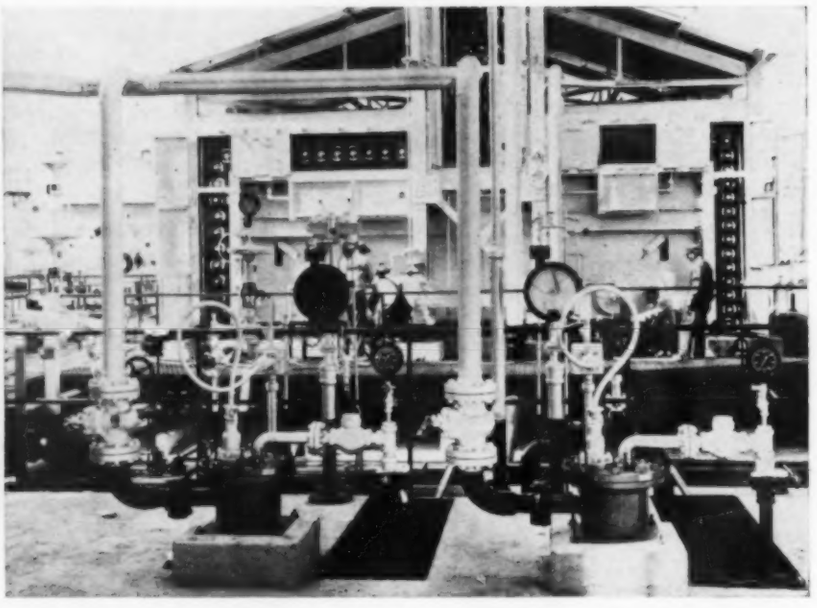


Fig. 3. Left—This Sterling vertical pump is one of several handling paper stock in the mill of the Beckett Paper Co.

Fig. 4. Right—These Byron Jackson "stuffingboxless" vertical pumps handle butane against a 692 ft. head for Union Oil Co.

as shown in Fig. 4. Here two "stuffingboxless" pumps with submerged 10-hp. motors deliver butane at 85 to 125 deg. F. against a head of 692 ft. Each pump has a capacity of 73 gal. per minute.

The same type of pump is used for handling gasoline. For example, a "stuffingboxless" vertical turbine pump in the Drunright, Okla., plant of Tidewater Oil takes gasoline from a storage tank and delivers 1,000 gal. per minute against 58 ft. head at 60 deg. F. Its motor is of 15 hp. Because of the low head, only one bowl and one impeller are required in this turbine pump.

HIGH PRESSURE VERTICALS

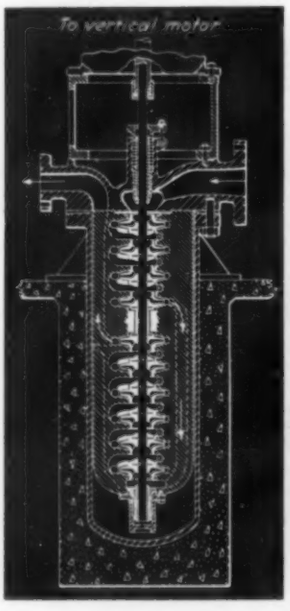
Another class of special vertical pump is the vertical multi-stage volute type. These pumps vary in number of stages from 5 to over 50, depending upon the pressure desired. Hydraulic balance is built in by having part of the stages pumping in one direction, while the remainder pump in the opposite direction, as shown in Fig. 5.

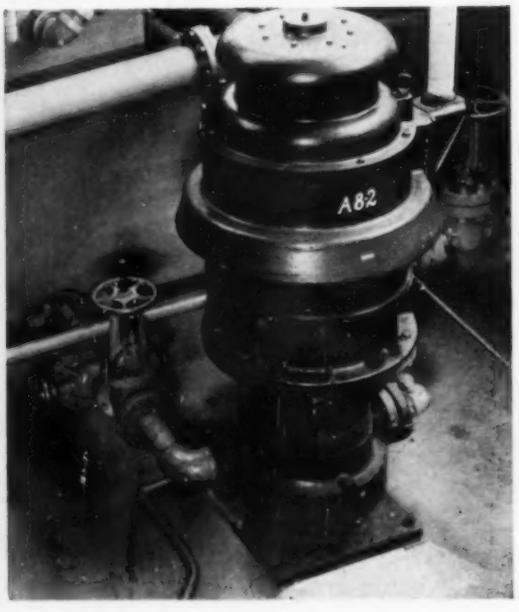
Pumps of this type have been built for heads of over 10,000 ft. and for pressures of around 3,000 lb. per sq.in. In oil refinery work such pumps have been used for handling oil at temperatures up to 900 deg. F. and pressures up to 2,800 lb. per sq.in. Capacities range up to 250 gal. per minute, power requirements to 250 hp.

One use for this type of pump, where its relatively small space requirement is of importance, is in central hydraulic systems for the operation of presses, such as are used in many types of processing plants. Such plants often obtain the required pressure from reciprocating pumps. When this is done, surge tanks and accumulators are necessary. These are not needed with the centrifugal type of pump, which therefore effects a great space saving. In Fig. 6 is shown one of a pair of these pumps, which pressure 78 presses making phonograph records in the Radio Corp.'s Indianapolis plant. These are 23-stage vertical volute centrifugals, each capable of delivering 120 gal. per minute at 1,800 lb. per sq.in. and each powered with a 200 hp. motor. Advantages of this type of installation are: (*a*) no shock at shut-off; (*b*) shut-off pressure only 5 to 20 per cent higher than normal working pressure; (*c*) greatly increased capacity at reduced pressure, during the filling cycle of the presses; and (*d*) reduced, rather than increased, horsepower requirements when pres-

Fig. 5. Left—Byron Jackson "Hydropress" vertical pumps are extending field of centrifugals to very high pressure work, such as in hydraulic pressing

Fig. 6. Right—One of two "Hydropress" pumps used by RCA to power 78 presses





sures are increased. The unit shown in the picture has a shut-off pressure of 1,900 lb. per sq.in., and will deliver slightly more than 200 gal. per minute at 1,250 lb. per sq.in.

Although major attention has been devoted to vertical centrifugal pumps in this series of articles, it must not be assumed that progress in recent years has been confined solely to the vertical designs. It is indeed true that great advances have also been made in the design and application of horizontal centrifugal pumps, rotary pumps and reciprocating pumps.

However, the purpose here has been to show some of the progress made in the design and application of water supply pumps, and in the adaptation of such pumps to process pumping problems. It is these vertical centrifugals, originally designed for water supply, that are least known in the process industries and offer, in general, the most ready opportunities for improved economy in process industry pumping. This is true not only because of the advances made in vertical pump design, but also because the possibilities of other types of pumps are better known in the chemical engineering field.

OTHER PUMPS

To make the story complete brief mention will be made of a few types of pumps other than the vertical, that fit into this picture of improved pumping economy.

One distinct advance made in recent years is the development by almost all pump makers of lines of small, standard centrifugal pumps in which the motor and pump are built together as a unit, often with the motor mounted directly on the pump casing or vice versa. With such pumping units, the assembly can be mounted in any convenient position, with the shaft horizontal, vertical or at an angle. This is a great help in making installations in crowded locations or directly on the equipment served by the pump.

Where positive delivery in exact quantities is in demand for process work, the rotary pump continues to give excellent service. A notable example of this is found in rayon manufacture where, to a considerable extent, rotary pumps of the gear type are used for positive delivery to the spinerets. Another type of use for the rotary pump is in proportioning, where exact quantities of two or more liquids must be delivered to fulfill the requirements of a formula or make an exact blend. An example of this latter type is shown in Fig. 7, which pictures seven rotary pumps in the lubricating oil blending plant of White Eagle Oil Co., at St. Paul.

HORIZONTAL CENTRIFUGALS

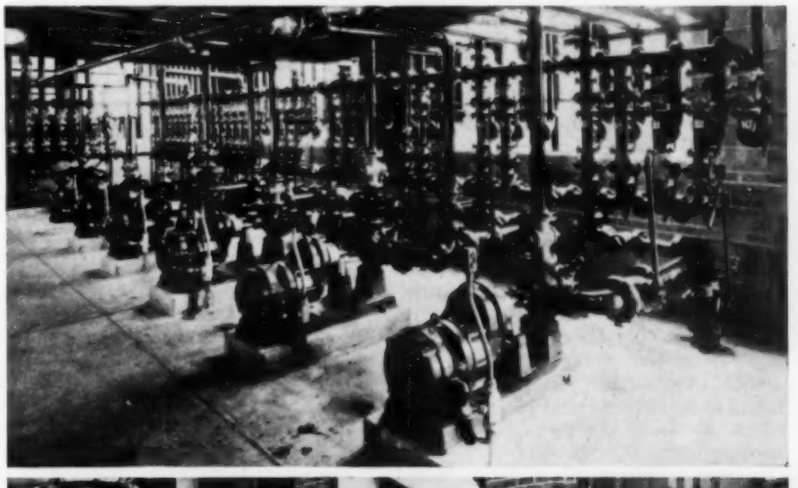
Finally, it must be emphasized again that the great improvements in vertical centrifugal pumps have in no way detracted from the usefulness of the horizontal centrifugal pump. For instance, Fig. 8 shows part of an installation of six horizontal centrifugal pumps of single suction volute type, driven by 125 hp. splashproof motors. These are non-clogging and acid-resisting, and are used for circulation purposes on a digester installation at Soundview Pulp Co., Everett, Wash. The motors are spring-mounted, to allow for expansion of piping and for vibration incidental to cooking operations in the digesters. This is an example of the type of installation in which the horizontal centrifugal pump is best and most economical.

In any case, the inference from the pump installations discussed in this and the preceding article is clear. The chemical engineer should not simply order a pump just like one he formerly used, when need for new pumping equipment arises. Rather, he should consult with engineers who are pump experts, so that full advantage can be taken of recent progress in pump design.

Acknowledgment is made by the author to the following pump manufacturers for illustrative material and information used in these articles: Pomona Pump Co., Pomona, Calif.; Byron Jackson Co., Los Angeles, Calif.; Sterling Pump Co., Hamilton, Ohio; Worthington Pump & Machinery Corp., Harrison, N. J.; Fairbanks, Morse & Co., Chicago, Ill.; Peerless Pump Co., Los Angeles, Calif.; Bingham Pump Co., Portland, Ore.; American-Marsh Pumps, Inc., Battle Creek, Mich.; and The Deming Co., Salem, Ohio.

Fig. 7—These Fairbanks-Morse rotary pumps are used in the lubricating oil blending plant of the White Eagle Oil Co.

Fig. 8—Horizontal, single-suction, volute centrifugal pumps of Fairbanks-Morse design, providing circulation for digesters of Soundview Pulp Co.



Power Show In Review

EDITORIAL STAFF REPORT

AS IN THE PAST, many developments of interest to chemical, as well as to mechanical, engineers were displayed at the Exposition of Power and Mechanical Engineering, held in New York. The current Power Show, the fourteenth of the series, occupied the attention of many engineers during the week of December 2. The report which follows attempts to single out from the many showing those developed in the period since the last Show, two years ago, which are likely to be of greatest interest to readers of *Chem. & Met.*

INSTRUMENTS

Developments among industrial instrument manufacturers were not as numerous as in some previous years. Bailey Meter Co., of Cleveland, is now equipping its meters with a fluorescent lighting unit within the case, for the illumination of the chart. This feature may be obtained as an extra on most instruments of the company's line, and is standard on the company's draft gages.

The Bristol Co., Waterbury, Conn., exhibited its new Free Vane Preset controller, designed particularly to avoid overshooting on batch feeding processes. This instrument is of the pneumatic type, designed to operate as a throttling controller while the batch is coming up to temperature. As the temperature approaches the control point, however, a time delay feature comes into operation which converts the controller, in effect, into an off-and-on instrument, permitting the mechanism to "wait and see" what the effect of each correction is before another correction is made. The delay effect is adjustable to fit the process. This company also showed its new electronic pyrometer, an indicating type employing a new sealed electronic relay. Actuation of the relay is obtained through a capacity effect between the pointer of the millivoltmeter indicator and an adjustable control pointer.

Among the new instruments shown by Brown Instrument Co., Philadelphia, is a new pneumatic transmitter said to obtain especially high accuracy through the use of matched bellows in the transmitter and receiving instruments. A novel feature of the design makes a pressure of 3 lb. in the air system equivalent to zero on the scale so that air failure will cause the receiver to indicate below zero, thus calling attention to the failure. This company has speeded up the integrator used with its flowmeters about four times and has added a new zero adjustment at the receiver.

Exhibited for the first time at the Power Show was the interchangeable orifice fitting made by Daniel Orifice Fitting Co., Los Angeles, Calif. This fitting permits removing and exchanging an orifice while the line is in service. The orifice is held in a special holder fitted with a rack so that it may be raised past a valve by a pinion operated by a hand crank.

A new instrument which is the electrical equivalent of modern pneumatic controllers having reset and throttling range adjustments, was presented by Leeds & Northrup Co., Philadelphia. The new Micromax electric control comprises three parts, a control instrument, a control unit and a valve-drive mechanism. The instrument is a standard Micromax and to this is connected the new control unit which is equipped with the throttling range and reset adjusting switches.

In addition to having redesigned the cases of all of its industrial instruments, the Mason-Neilan Regulator Co., Boston, has designed several new types of diaphragm control valves, which were shown. One, called the Freeflow valve, is a large angle type with a specially designed plunger-type plug and a venturi-like seat. The direction of flow is through the side connection, around the plunger and out through the venturi. Another novel construction is a butterfly valve actuated by a diaphragm top in which motion of the diaphragm is transmitted to the butterfly by means of a cam cut in the valve stem, which causes rotation of the stem with movement of the diaphragm.

An interesting flame control system employing a radiation-sensitive instrument known as the Visaflame, was shown by the Mercoid Corp., Chicago. This device incorporates in one sealed unit an ambient-temperature-compensated bimetallic radiation-sensitive element and a mercury switch. Light from the flame is concentrated by a reflector on the sensitive element. Flame failure causes the instrument to open the mercury switch and shut down the burner.

A novel phototester exhibited by the National Aluminate Corp., Chicago, was developed as a convenient means of making water analyses. The unit determines quantitatively calcium, magnesium, phosphate, silica, alumina, sulphate, iron, oxygen, pH, and organic inhibitors by judging color intensity with a photocell.

Several new electronic devices were shown by Photoswitch, Inc., Cambridge, Mass., a new exhibitor at the Power Show. A liquid lever controller consisted of two capacity probes—one at the desired high level and one at the desired low level. A potential is applied to these probes and their capacities vary when the space between them is filled with liquid instead of air, thus actuating an electrical circuit controlling a pump. A photo-electric smoke indicator for combustion control was another unit on display. Another interesting development of this company is a high-speed photoelectric counter, capable of counting up to 120 counts per second. This device is completely electronic.

Among the several recent developments of Republic Flowmeters Co., Chicago, Ill., was a new type draft gage, designed for compact multiple mounting on panels. The new instrument employs a diaphragm measuring element with a pointer moving on a curved illuminated scale. Individual units are readily removed.

An improved automatic coal scale, used also for other lump and granular materials, was shown by Richardson Scale Co., Clifton, N. J. The new scale comprises a rubber feed belt discharging on to a weigh hopper. When the hopper receives a predetermined weight, the feeder stops, the hopper opens and discharges and the weight is registered.

New instruments exhibited by Taylor Instrument Cos., Rochester, N. Y., included a new remote transmitter operating on the pneumatic principle and the company's new Flex-O-Timer. This device has a shaft carrying a revolving drum on which are a number of circumferential undercut grooves, in which are adjustable pins locked in place by a screw. These pins actuate either air valves or electric switches as desired at set points in a cycle.

Employing the same "radio" principle as its earlier developed instruments, Wheelco Instruments Co., Chicago, Ill., has designed a new remote controller which was shown operating a liquid level control. This instrument consists of an electronic tube, a transformer, a relay and associated parts, mounted in a dustproof case

with a signal light to show when shut-off or control action occurs. This assembly is used with a number of types of pick-up for the control of various functions.

PUMPS

Several new pumps were exhibited. Among these was the Electrifugal pump made by Allis-Chalmers Mfg. Co., Milwaukee. This new close-coupled pump and motor combination is a development of earlier designs, employing a motor especially developed for the service. The new design has greatly increased the mechanical strength and reduced the number of parts, according to the maker. Standard units are equipped with splash-proof motors while dust-proof and explosion-proof motors can be had.

A variable capacity pump, for boiler feeding, process use and the powering of hydraulic pressing operations, was exhibited by Aldrich Pump Co., Allentown, Pa. This pump is a variable-stroke, vertical, triplex type with a novel stroke-varying feature. The pistons are reciprocated by means of oscillating links driven by connecting rods. One end of each oscillating link is constrained to travel along a fixed arc path, but this path may be tilted, manually or automatically, so as to cause the other end of the link to reciprocate as desired.

The Packless centrifugal pump recently developed by the Allen-Sherman-Hoff Co., Philadelphia, was shown in its latest modification. This pump, a centrifugal lined with rubber or neoprene, is of the horizontal-impeller type with vertical shaft. The suction chamber seals the intake, hence packing is not needed.

A pump having interesting possibilities, not only for boiler feeding, but also for high pressure chemical operations was exhibited by the J. S. Coffin, Jr., Co., Englewood, N. J. This pump, originally developed for locomotive boiler feed service, is a high-speed, direct-turbine-driven centrifugal, capable of producing extremely high pressures in a single stage.

An oil pressure unit shown by Duraametallic Corp., Newark, N. J., is designed to circulate lubricating oil at a uniform pressure and has found applications principally in the petroleum industry. A pump supplies oil from a water-cooled tank through a filter. The tank is equipped with a pressure regulating valve on the return line to assure uniform pressure.

A new proportioning pump, Type R, developed by Hills-McCanna Co., Chicago, Ill., was exhibited. The actuating mechanism consists of a balanced walking beam type rocker arm which operates a reciprocating pump plunger.

Nash Engineering Co., South Norwalk, Conn., exhibited its recently developed standard type Nash-Corning glass centrifugal pump, together with a new small glass centrifugal of 40-50 g.p.m. capacity. These new pumps employ Pyrex glass casings and impellers, a special Pyrex and composition rotating seal, and a metal armoring or inclosing casing for the glass, equipped with springs to allow the two halves of the glass casing to separate in case of over-pressure.

Shown for the first time at the Power Show was the Motoair compressor of the New Jersey Machine Corp., Hoboken, N. J. This is of the positive displacement type, with an eccentric rotor and sliding blades.

Several improvements were evident in the line of small proportioning pumps exhibited by Proportioneers, Inc., Providence, R. I. An interesting innovation employed on the company's small diaphragm and plunger Adjust-O-Feeders is the use of a pump chamber molded of transparent plastic. This company showed an oil-immersed stuffing box for sulphuric acid feeding pumps, designed to prevent entrance of air and thus materially reduce maintenance.

A new barrel pump for heavy viscous material such as heavy greases, plastics, cement, etc., was shown by the Trabon Engineering Corp., Cleveland. A gear pump operated by a direct-connected motor supplies oil to a hydraulic cylinder above the barrel. Another cylinder on the same shaft is placed down in the barrel and pumps the viscous material from the barrel on the upstroke.

New packing materials were shown by two companies. The Marlo Co., New York, exhibited a fibrous glass packing recommended for pumps and valves handling hydrochloric and mixed acids. This company also exhibited its 57-M alloy packing developed specifically for high temperature catalytic cracking in the petroleum industry. The Garlock Packing Co. of Palmyra, N. Y., exhibited its Lattice-Braid packing, a new development in braiding. Advantages claimed are elimination of ravelling, longer service, flexibility, and increased porosity.

VALVES, TUBES, TRAPS

Developments in valves of various sorts, and associated equipment, were numerous. The Automatic Switch Co., New York, exhibited its new solenoid-pilot-controlled four-way valve which has its principal application for compressors and hydraulic presses. This is a poppet type valve, diaphragm operated, manufactured for pressures up to 200 lb. This company also showed a new free-handle safety shut-off valve.

The booth of Black, Sivalls & Bryson, Kansas City, Mo., contained three new pieces of equipment. One was a new conservation vent valve of the cantilever type, sealed by the pressure of the fluid within the system. When the pressure goes too high, the valve rises until the pressure is released. The valve also operates in case of a vacuum in the pipe. Other new items in this booth were two combination safety head-relief valve units. One of these, for gas installation, has the safety head rupture disk installed after the relief valve in such a way that the relief valve can stand open during normal operations, but closes after the rupture disk breaks and the pressure is returned to normal. Another, for liquid installations, has the safety head rupture disk installed before the relief valve.

Valve seats produced by a new process imparting exceptional hardness were exhibited by the Chapman Valve Mfg. Co., Indian Orchard, Mass. The new process, developed by the Chapman organization jointly with the Drever Co., Philadelphia, is a method of nitriding stainless steels. The resulting product is a hard-surfaced stainless having a surface hardness of 900 diamond Brinell. Ammonia gas is cracked, then ionized and supplied to the treating furnace. The product has a corrosion resistance fully equal to that of the untreated stainless steel.

Crane Co., Chicago, showed a new line of carbon steel valves with screwed, flanged and socket-weld ends, in globe, gate, check, ball-check and angle types. An improved form of stuffing box tightener is featured. The Fairbanks Co., New York, showed two new lines of valves, a series of iron-body U-bolt gate valves for 150 lb. steam, and a series of bronze gate valves of screwed bonnet construction.

Thomas A. Edison, Inc., West Orange, N. J., exhibited a thermostatic valve for supplying heating steam to processes. The novel feature is the use of the heat in the steam to vaporize the thermostatic liquid contained in the bulb and capillary, thus giving an effect said to be equivalent to that obtained with air or hydraulic actuated pilot systems. As the bulb temperature rises some of the liquid is forced into the steam heated bellows of the valve, there vaporizing and tending to throttle the steam. A second bellows in the valve, filled with nitrogen, acts to correct for changes in steam temperature.

An anti-coking valve for use in the petroleum refining industry was shown by Fisher Governor Co., Marshalltown, Iowa. Recommended for heavy product service, such as residuum stills, it is a sweep flow type valve operated by instrument air. The unique feature is a hand wheel for manual operation.

Foster Engineering Co., Newark, N. J., demonstrated its new air-dome

pressure regulating valves. This new type requires no spring or weight loading, employing instead a diaphragm loaded with air pressure.

Among the developments exhibited by Jenkins Bros., New York, was a series of bronze globe valves for water service, featuring outside screw-and-yoke construction with stainless trim and spindle. This company showed new patterns of stainless steel valves, as well as new stainless compositions.

Packless Metal Products Corp., Long Island City, N. Y., exhibited its new Packless swivel joint for connecting steam or fluid lines to a rotating member. The joint is recommended for use for any pressures from high vacuum to 5,000 lb. per sq. in. It has a sleeve type construction, employing metal-to-metal contact. Also exhibited was a new large size seamless flexible tube 10 in. inside diameter.

Dual-Gage tubing is the name of a new development of Phelps Dodge Copper Products Corp., New York. Through a new tube forming process, this company is now able to put extra metal into the wall of the tube to reinforce it at any desired spot, such as on the inside of a bend.

A complete line of its novel disk-sealed, quarter-turn plug valves for use in all services of chemical industry was exhibited by the Valve Division of Reed Roller Bit Co., Houston, Tex. The Reed valve is now supplied built of corrosion-resistant materials.

Among the new developments shown by the Sarco Co., New York, was a new steam and water mixer, especially designed for quietness. A new float trap was shown, featuring a double-seated balanced valve, unusual in this type of equipment. Another new showing was an improved cooling valve for diesel engine jacket water.

Spence Engineering Co., Waldon, N. Y., exhibited a new combined temperature and pressure regulator of the pilot-operated type. Another new showing was a steam-atomizing desuperheater in which water for desuperheating is sprayed into the main by a steam nozzle. This company also showed the new Fall-O-Matic universal pipe intersection cutter, a device for automatically cutting a pipe end for any kind of intersection. Five cranks on the machine are set at settings depending on the sizes of the two meeting pipes and the intersection angle. As a crank is turned, the pipe is automatically rotated and the cutting torch is moved so as to cut the pipe end exactly as required.

Henry Vogt Machine Co., Louisville, Ky., announced two new sizes of American standard gate valves—the 150-lb. and 300-lb. sizes. These are made with stainless steel trim for 4- to 8-in. lines inclusive. This company also exhibited a new line of general-purpose gate valves.

A new development in the line of Impulse steam traps manufactured by Yarnall-Waring Co., Philadelphia, Pa., is the Superpressure type with integral strainer, available for pressures of 600 and 1,500 lb.

POWER TRANSMISSION

New bearings, drives and other power transmission devices were well represented. Neoprene sealing rings were featured in two pieces of equipment, one of which was a ball bearing pillow block exhibited by the Alberg Bearing Co., Chicago, in which the sealing ring was mounted so as to rotate with the shaft, thus minimizing wear. The Waldron gear-type coupling, shown by John Waldron Corp., New Brunswick, N. J., was equipped with a neoprene seal.

An improved design of scoop-controlled hydraulic coupling for variable speed power transmission, was exhibited by the Hydraulic Coupling Div. of American Blower Corp., Detroit, Mich. This coupling is a self-contained type, requiring neither pump nor separate oil reservoir for regulating the working oil in the coupling.

Interesting construction was evident in the new American Reduction drive exhibited by the American Pulley Co., Philadelphia, Pa. This device comprises a simple spur-geared reduction unit contained within a cylindrical casing for direct mounting on the input shaft of the driven machine. The unit requires no separate foundation.

Ideal Commutator Dresser Co., Sycamore, Ill., exhibited an improvement for its variable speed transmission, in the form of a motorized control.

A new line of self-aligning roller bearings was introduced by Link-Belt Co., Chicago, Ill. These bearings are of the double-roller type having an inner race with a spherical shaped surface and two outer races also with spherical surfaces. The rollers themselves are concave.

Morse Chain Co., Ithaca, N. Y. showed a new 60-hp. silent chain drive with a chain velocity of 5,000 ft. per min. at a motor speed of 1,750 r.p.m. A number of advantages were listed such as longer life, less space requirement, lower bearing load, quiet operation and low cost.

Philadelphia Gear Works, Philadelphia, Pa., showed its recently developed PlaneTorque motorized speed reducer, an in-line planetary type incorporating an overload power cut-off. Whenever excessive torque is imposed on the output shaft, the increased torque required to rotate the planet gears actuates a switch and disconnects the power.

SKF Industries, Inc., Philadelphia, showed its new Rubber Flex ball bearing pillow block designed especially for quiet operation. The bearing has a long inner race and a short outer race with a double ball bearing in between and a rubber ring outside the outer race. The new Sealmaster dust-proof ball bearing was shown by Stephens-Adamson Mfg. Co., Aurora, Ill. The seal is a combined felt and steel labyrinth type, impregnated with a special grease. Both the races and the balls themselves are oil impregnated.

A preset control for variable speed drives was exhibited by Sterling Electric Motors, Inc., Los Angeles, Calif. It is made so that the operator need merely set a dial at the speed desired.

CONSTRUCTION MATERIALS

A considerable number of developments was evident in the field of construction materials. Allegheny-Ludlum Steel Corp., Brackenridge, Pa., exhibited samples made by its new Pluramelt process in which a plymetal is produced by actually melting the plying material on to the base metal. This company's new Ludlite Bord was also shown, a structural material consisting of a sheet of stainless steel of about 0.009 in. thickness, cemented on to an asphalt-impregnated board. New corrosion-resistant copper wall panels were shown by the American Brass Co., Waterbury, Conn. The embossed copper panel is attached to ½ in. of insulating board.

American Steel & Wire Co., Chicago, demonstrated results of its recent researches on electrically conducting rubber compositions, intended particularly as an external coating for rubber-covered cables for handling voltages of 3,000 and more. Use of the conducting coating eliminates corona discharge and contributes to safety.

Ampco Metal, Inc., Milwaukee, exhibited its new coated aluminum-bronze electrodes and welding rods with the properties of Ampco metal.

A new asbestos-felt pipe covering for underground or trench work was exhibited by Philip Cary Co., Lockland, Cincinnati, Ohio. Composed of particles of sponge embedded in felt, it is recommended for temperatures of 200 to 500 deg. F. where the conditions of service are unusually severe.

INSULATION AND REFRACTORIES

Exhibited at the Show for the first time was a protective coating for furnace linings called Brickseal. The Brickseal Refractories Co., Hoboken, N. J., asserts that this material produces a highly glazed, smooth and jointless surface, protecting the refractories up to 3,000 deg. F.

Two new mullite refractories were shown by the Carborundum Co., Perth Amboy, N. J. The refractory known as Mullfrax is made from bonded electric furnace mullite. Mullfrax S is a converted kyanite refractory, said to be particularly resistant to heat shock.

The new Supertemp block made of high temperature insulating wool was shown by Eagle-Picher Sales Co., Cincinnati, Ohio. These light-weight, water-repellent blocks are said to resist temperatures up to 1,700 deg. F. Baldwin-Hill Co., Trenton, N. J.,

showed its new Mono-block insulation. It is rockwool felted and bonded together to form a light-weight block that may be easily cut and fitted around equipment having irregular as well as flat surfaces. The manufacturer recommends it for temperatures up to 1,600 deg. F.

L-W Superex is the name of a new insulation exhibited by Johns-Manville, New York. Adapted for use at temeratures up to 1,500 deg. F., the new product is obtainable in block and pipe insulation. Keasbey & Mattison Co., Ambler, Pa., exhibited its new line of Century cement-asbestos pipe for water, available in diameters from 3 to 12 in. A new fibrous glass insulating block for temperatures to 1,200 deg. F. and designated as Type 120, was shown by Owens-Corning Fiberglas Corp., Toledo, Ohio.

ELECTRICAL EQUIPMENT

Many new products were exhibited by Allen-Bradley Co., Milwaukee, Wis. Switches with fully insulated push buttons to prevent sparking were shown; also, new switch covers made of molded plastic for push-button stations. A new 150-amp, magnetic across-the-line motor starter exhibited is the largest size solenoid-operated starter made by this company and it was rated 50 hp. at 220 volts or 100 hp. at 440 or 550 volts. Double-break silver alloy contacts were a feature of its construction.

Several new products were shown by Benjamin Electric Mfg. Co., Des Plaines, Ill. A new 60-in. 100-watt fluorescent tube lighting fixture was shown and recommended for general lighting at about 15 to 16 ft. heights. Vapor-proof fluorescent fixtures for two or three 48-in. tubes were also exhibited.

An inclosed sectional control center known as Unitrol was exhibited by Cutler-Hammer Co., Inc., Milwaukee, Wis. Extreme flexibility is provided for in these panels in that any number of units may be connected together side by side, in ells, back to back, or in various other arrangements. Electric Arc Cutting & Welding Co., Newark, N. J., exhibited a new high-frequency pre-heating and stress-relieving unit for welded pipe which has been developed to do away with transformers.

Two new diesel engine applications were shown by the Detroit Diesel Division of General Motors Corp., Detroit, Mich. One was a portable diesel generator complete with engine, cooling system and generator, available for 30, 40 and 60 kw. output and designed particularly for emergency use. The other was a stand-by fire pump of 2,000 g.p.m. capacity at 100 lb. per sq. in. pressure powered with a diesel operating at 1750 r.p.m. and producing 170 b.hp. at rated capacity. This new type of diesel is claimed to be smaller and lighter for a given horsepower than an equivalent gasoline engine.

MISCELLANEOUS

A number of developments not capable of classification among the above headings were also found in various booths. A demonstration of the principle of the gas turbine was presented in the booth of Allis-Chalmers Mfg. Co., Milwaukee, Wis. This turbine, which is now becoming important in the United States in certain refining operations, comprises a turbine and compressor on the same shaft. Combustion air is compressed and then supplied to a burner where it is mixed with the fuel so that the combustion products are at relatively high pressure. These combustion gases are then expanded through the turbine.

American Blower Corp., Detroit, Mich., showed its new capillary air washer in which contact between the air stream and the water used for washing, humidifying or dehumidifying is obtained in a capillary cell consisting of a tremendous number of glass fibers arranged parallel.

Exhibiting at the Show for the first time was the C. & C. Corp., New York, showing new methods for reconditioning old condenser tubes. The company has three pneumatic tools for this work, cutter, puller and gripper. Tubes may be cut in this way at the rate of twenty per minute, it is claimed. Tubes are pulled by cutting off the rolled portion at one end and pulling at the other end. The main advantage of this reconditioning, however, comes in tube stretching. By gripping a tube at one end and pulling at the other a condenser tube may be stretched as much as 4 or 5 in. Then the ends of the tube, where corrosion and pitting usually occurs first, may be cut off and the tubes rerolled.

Hartzell Propeller Fan. Co., Piqua, Ohio, exhibited for the first time its "Teardrop" fan blade for use in all types of Hartzell fans and blowers. This new propeller involves a totally new application of aerodynamics, according to the company. The airfoil section is designed to allow the use of a sweeping curve on the face of the propeller without the turbulence of air which normally follows this treatment. The "Teardrop" blade is said to work up against higher static pressures.

A safety reflex gage glass which has been used for some time in the petroleum industry, but is now becoming widely used in chemical industry, was shown by the Jerguson Gage & Valve Co., Somerville, Mass. The viewing glass has longitudinal corrugations on the back which normally reflect the incident light. However, when these corrugations are filled with liquid, the light is not reflected and a viewer may see the back of the liquid chamber, giving a clean-cut definition of the liquid level.

In the booth of the Modine Manufacturing Co., Racine, Wis., was displayed a new vertical delivery unit heater. The heater was designed for special application where the horizontal type is not satisfactory.

Several developments in water treatment were exhibited including two systems for the removal of silica from boiler feed water. Silica scale is particularly detrimental in high pressure boiler tubes. The Allis-Chalmers Mfg. Co., Milwaukee, Wis., has developed a special high-magnesium lime known as Silimite which is used, generally instead of ordinary lime, or at least to replace a part of it in an ordinary lime-soda hot-process softener. The Permutit Co., New York, employs various magnesia-containing materials such as calcined dolomite. Treatment may be separate or in conjunction with other treatments. An improved system for applying the chloramine process for slime control in condenser and cooling water systems, was explained by Proportioneers, Inc., Providence, R. I. This method comprises the simultaneous use of a hypochlorite and aqua ammonia or ammonium sulphate. The equipment includes two proportioning pumps on a single base, driven from a common shaft.

Several improved dust-handling systems were shown. Allen-Sherman-Hoff Co., Philadelphia, Pa., displayed an improved form of Hydrovac dust handling system for the dustless discharge of dust hoppers. This system employs an air current produced by a water jet to sweep the dust from a specially designed outlet valve attached to the hopper bottom. The latest design of outlet valve is opened and closed by means of a timer-controlled, motor-driven shaft, capable of handling up to four outlet valves in rotation. An improvement exhibited by the Buell Engineering Co., New York, intended for collection of coarse dust is known as the Low-Draft-Loss collector. The new element is a wedge of vertical tubes which can be fitted into an existing flue. Coarse dust is thrown out, outside the wedge, while the accompanying gas or air and fine dust passes between the tube to be separated by one of this company's standard type collectors. Another new development in cyclone type collectors was that of Prat-Daniel Corp., Port Chester, N. Y. A group of double-inlet cyclones is used, each cyclone consisting of a cylindrical tube with two slots in the upper portion, the slots having tangential vanes.

Two new lift trucks were shown by Barret-Cravens Co., Chicago, Ill. One is an hydraulic lift type, featuring both hydraulic lifting and releasing, suitable for loads up to 15,000 lb., with a lift as high as 8 in. The other is a new inexpensive multiple-stroke truck for 2,500 and 3,500 lb. capacity, employing a mechanical lift and hydraulic release. New at the Show this year, the Mobilift Co., of New York, exhibited a line of light-weight motor-operated lifts, gasoline-powered and designed for less than 1-ton loads.

Machinery, Materials and Products

Chem & Met Process Equipment NEWS

Improved Proportioner

SEVERAL IMPROVEMENTS in the design of its Model B reagent feeder have been announced by D. W. Haering & Co., 2308 South Winchester Ave., Chicago, Ill. This proportioner, shown in an accompanying view, operates on the fluid piston principle in which the reagent is forced from the second of two tanks into the line by an immiscible oil which serves as a fluid piston. The oil is in turn displaced from the first tank by the liquid being treated. The rate of displacement depends upon the pressure differential set up by two opposed pitot tubes in the primary liquid line.

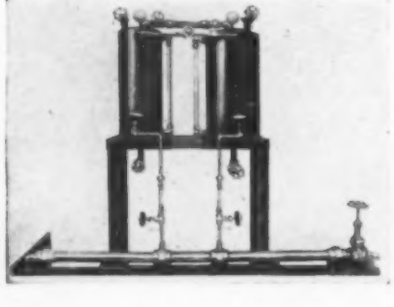
The new feeder makes use of several lengths of flexible metal tubing to take up water hammer shocks. The gage glasses are now installed on the inside of the unit, facing each other. Overall height of the fluid compartments has been increased to provide greater capacity, and safety against oil losses.

High Pressure Trap

FOR USE on steam, air and gasoline at pressures of 500 to 1,500 lb., and temperatures to 1,000 deg. F., W. H. Nicholson & Co., 12 Oregon St., Wilkes-Barre, Pa., has developed a cast-steel, weight-operated trap available in sizes from ½ to 1 in. The working parts are of stainless steel with Stellited valves and seats. Construction is indicated in the accompanying drawing.

Water entering the trap raises the float to its highest point of travel where it releases a weight latch, allowing a counterweight to fall. The counterweight is attached to a crank which lifts the discharge valve wide open, doing so instantly. The discharge valve is held wide open by a link latch until the discharging water carries the float to the lowest point of its travel, at which point the weight latch again engages the counterweight, which has been lifted by the falling float, and the link latch disengages, permitting instantaneous closing of the discharge valve. Wire drawing is thereby said to be eliminated. The novel feature of this method of operation is that the float is instrumental only in releasing the counterweight, the latter being the agency for operating the valve.

Improved Model B reagent feeder

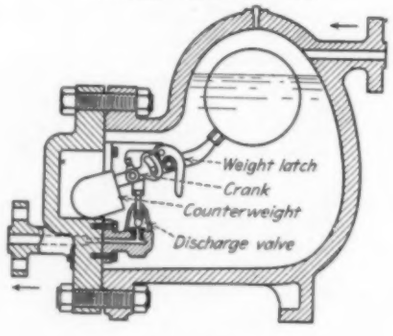


Angleflow Pumps

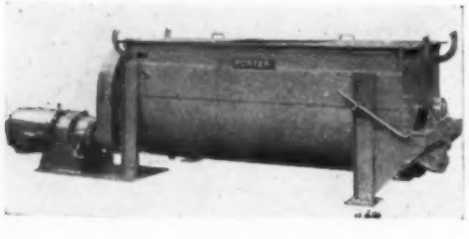
A LINE of pumps which has been given the name of Angleflow, available in both vertical and horizontal types, has been released by Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago, Ill. These pumps are designed for large capacity pumping under low head conditions. In principle they combine the features of earlier types of low head pumping equipment, resulting in flow through the propeller at an angle to the axis of rotation of the pump. This feature is evident from the accompanying cross-sectional drawing.

Also evident is the fact that the pump employs a volute for pressure recovery so that diffusers are unnecessary, making the unit suitable for handling water containing foreign matter. Both vertical and horizontal shaft types are provided, in standard sizes up to 54-in. discharge, with larger sizes available to special order. Features of the pump include specially designed, streamlined water passages, large and adequate bearings, and two sets of double and replaceable wearing rings on the specially designed impeller.

Cross-section of new trap



Double-ribbon mixer



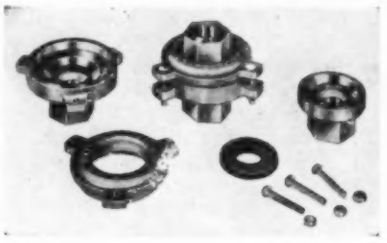
Ribbon Mixers

MATERIALS ranging from dry powders to heavy viscous pastes may be mixed efficiently, according to the manufacturer, in a new line of double-ribbon mixing machines introduced by the H. K. Porter Co., 4914 Harrison St., Pittsburgh, Pa. Two metal ribbons on a shaft revolve close to the surface of the mixing cylinder so as to create a double folding action on the materials being mixed. The mixture is automatically worked toward the discharge end of the cylinder. The cylinder is inclosed within a baffled jacket for either heating or cooling. Total inclosure of working parts and the use of end-seal-protected antifriction bearings are important features of the design. All sizes from laboratory to large production size are available.

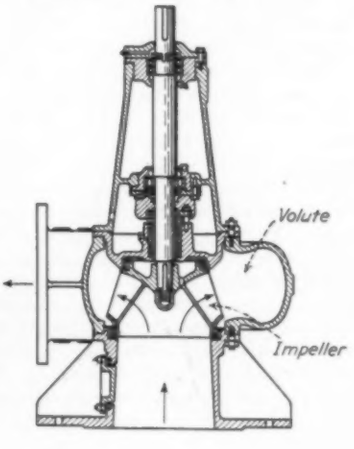
Steam Swing Joint

FOR HANDLING steam pressures up to 100 lb., Patterson-Ballagh Corp., 1900 East 65th St., Los Angeles, Calif., has introduced, in the ¾-in. size, a simple bronze swing joint incorporating a sealing unit made of specially shaped

Swing joint for steamlines



Angleflow low-head pump



Low head-room granulator

Non-sparking lift truck

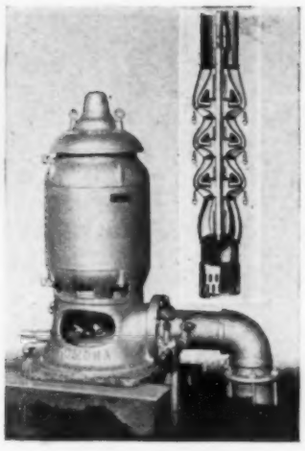
and compounded rubber. This rubber gasket contains a percentage of finely divided metallic lead, milled into the rubber, to act as a lubricant. This insures easy turning of the joint under pressure, according to the manufacturer.

Granulating Machine

DESIGNED especially for use where head-room is limited, a new automatic screen granulating machine of large capacity has been announced by the F. J. Stokes Machine Co., Philadelphia, Pa. The machine is intended for breaking down lumps formed while materials are being processed or standing in containers; and for reducing to free-flowing powders materials coming from dryers, filter presses, etc. When fitted with screens of the proper mesh, the granulator is said to be suitable for preparing materials for tabletting and briquetting. The machine is of all steel construction, tightly housed to prevent escape of dust. The design is a modification of the company's standard oscillating granulator, altered to reduce overall height to permit installation directly under a dryer or other machine.

Non-Sparking Truck

OF PARTICULAR INTEREST to explosives manufacturers is a new line of lift trucks for handling loaded skids, now available in non-sparking bronze alloy and manufactured by the Barrett-Cravens Co., 3250 West 30th St., Chicago, Ill. Sixteen models are made in a variety of sizes, some models also being built in aluminum. A line of



Redesigned deep well turbine pump

skids for the handling of explosives with the special trucks comes in a wide range of types, with legs covered with vulcanized rubber. The company is also prepared to supply portable elevators in various types, also of non-sparking construction, with air-driven hoists to eliminate electric motors and wiring, or with explosion-proof motors.

Deep Well Pump

COMPLETE REDESIGN of its line of 6-in., medium-capacity, vertical, turbine pumps for deep-well use has been announced by the Pomona Pump Co., 663 East Commercial St., Pomona, Calif. As a result of the improved design, the pump efficiency is said to have been materially increased. For example, to obtain a capacity of 100 g.p.m. against 110 ft. lift in the well, and 50 lb. pressure above, a 7½ hp. motor is required, as against a 10 hp. motor with the old model. This increase in efficiency has permitted reducing the number of stages one-fourth and has lowered the initial cost of the entire unit by 20 per cent. These pumps are water-lubricated and have no stuffing box below ground level. The specially designed semi-open impellers can be adjusted from the surface for wear and for changing capacities. Correct curvature of the bronze impeller vanes is said to assure maximum lifting capacity and prevent overloading of the motor, regardless of changes in the water level.

New Products

"WELDWOOD" is the name of a new urea formaldehyde glue recently introduced by the United States Plywood Co., 46th St. and 12th Ave., New York, N. Y. The new glue, working by chemical action, is a first cousin to Plaskon, the urea formaldehyde plastic manufactured by the Plaskon Co., Toledo, Ohio. Supplied in the form of a powder, it is mixed with cold water and requires no separate hardener or catalyst, nor is heat necessary after application. Tests made so far are said to have indicated no case in which the permanent, waterproof bond formed between the wood pieces has failed in the joint.

COMPLETE RESISTANCE to water, alkalis and petroleum products, with a high degree of resistance to most chemicals including acids, is claimed for ParaTex, a new rubber-base floor coating recently introduced by the Truscon Laboratories, Detroit, Mich. This new paint is designed particularly for the coating of concrete floors. Covering at the rate of 300 to 400 sq.ft. per gal., it is claimed to have high hiding power and to require only one coat in most cases. Hardening of the paint does not depend on oxidation so that the material is stated to be remarkably quick drying.

A RECENT announcement from the Petroleum Chemicals Dept. of Monsanto Chemical Co., St. Louis, Mo., describes a new additive for crankcase oils which is claimed to have several desirable effects. The new material, known as Santolube 261, is claimed to impart a high degree of detergency to the oil, to have a favorable effect on the viscosity index, to inhibit oxidation of the oil, to prevent bearing corrosion and to eliminate need for incorporating a separate pour-point depressant.

FLUID EMULSIONS containing electrolytes are easily made, according to the manufacturer, with Emuldor A, a new emulsifying agent now being produced by Glyco Products Co., 148 Lafayette St., New York, N. Y. This wax-like material has a melting point of 44-53 deg. C. and a specific gravity of 1.04 to 1.06 at 25 deg. C. It is dispersible in hot water and is recommended by the maker for use in cosmetics, textiles, paper, leather and other purposes where an electrolyte-containing emulsion is required.

Equipment Briefs

STRENGTH under test of 3,900 lb. is claimed for a new steel safety-belt tail line introduced by Mine Safety Appliances Co., Braddock, Thomas and Meade Sts., Pittsburgh, Pa. The new line is for attachment to the safety belt of workers inside tanks and other dangerous equipment, and consists of an aircraft-type cable, supplied with drop forged steel snaps at either end, and a quarter-inch covering of material resistant to weathering, oil and abrasive action. Exclusive of the covering the cable is but 3/16 in. in diameter.

TO PERMIT increased rate of operation with zeolite water softeners, the Elgin Softener Corp., Elgin, Ill., has developed what is known as the "Double-Check" strainer system, a system designed to prevent loss of zeolite and obtain better water distribution,

thus permitting the use of a larger amount of zeolite in a softener of a given size. The new system is available on new equipment, as well as for the modernization of existing equipment. It is claimed to increase the capacity of a given size softener up to 25 to 35 per cent, and to make an appreciable saving in the salt required for regeneration.

A NEW fork truck designated as ERS3T, capable of elevating loads on skids or pallets to three levels instead of one, has been introduced by Elwell-Parker Electric Co., Cleveland, Ohio. The elevating mechanism is built in three telescoping sections so that the fork can be raised to 50½ in. on the first lift, 88½ in. on the second and 112 in. on the third, at an upward travel rate of 20 ft. per min. with a 1,500-lb. load. With the telescoping members lowered, the overall height of the truck is but 74 in. The truck is electric powered.

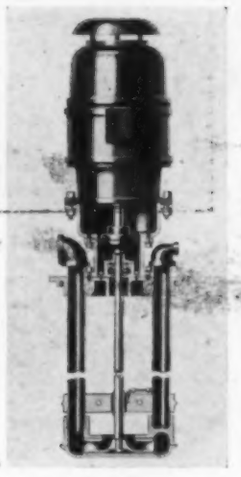
WHAT IS KNOWN as the Direct Result Colorimeter is a new instrument recently designed by Spencer Lens Co., Buffalo, N. Y. for direct reading of the percentage concentration of the unknown in terms of the known colored substance. The instrument has its own light source, employing two glass cups, one for the standard and the other for the unknown, into which light transmitting plungers are dipped to measurable depths. Light transmitted through the two plungers is compared with a single eye-piece by combining in a biprism. Percentage concentration at equal illumination of the two halves of the prism is read directly on the graduated drums controlling the movement of the plungers.

FOR HEAVY industrial construction and maintenance work, the Insto-Gas Corp., 1900 East Jefferson Ave., Detroit, Mich., has recently added to its line of Insto-Gas torches the No. 5 Super Torch, giving sufficient flame heat for heating and soldering pipes over 6 in. in diameter. The new torch is also suitable for crisping paint on brick and concrete surfaces before sandblasting and for large copper tank work. It delivers up to 200,000 B.t.u. per hr. with the flame ranging from 6 to 24 in. in length. The unit consists of a torch, hose and separate bottled-gas cylinder. Such cylinders are leased to customers and exchanged for full ones at distributing points when empty.

AN IMPROVED CONVEYOR of the vibrating type, featuring totally inclosed design, minimum headroom and rubber shackled pan mounting has been announced by the Shaker Division of the Ajax Flexible Coupling Co., Westfield, N. Y. The conveyor is powered by a self-contained reciprocating drive which is self-balancing and is said to eliminate transmission of the vibration to the surrounding structure. As a consequence, power consumption is said to be extremely small.

Combination safety head and pop valve

New humidity control



Type SW pump

ENTIRELY NEW in principle according to the manufacturer, the new Security Lock Nut has been introduced by Security Metal Products, Inc., 374 East Kalamazoo Ave., Kalamazoo, Mich. The new nut may be reapplied many times without losing its gripping power, according to claims. The gripping element consists of a slightly elliptical shaped spring-steel retainer, permanently sealed in the head of a standard nut. The retainer is distorted to circular shape by the bolt.

Combination Safety Valves

TWO NEW combination safety valves incorporating a safety-head rupture member in an ordinary pop valve have been announced by Black, Sivalls & Bryson, Inc., Kansas City, Mo. One unit is designed for gas service and the other for liquid service. The gas service unit has the pop valve disk in contact with the gas. In use the valve is automatically held open by gas pressure on a diaphragm, the pressure being retained by the rupture disk. Over-pressure to an extent determined by the characteristics of the disk ruptures the latter and permits relief. The valve diaphragm, no longer being under pressure after relief, permits the valve to close when the emergency has passed. A new rupture disk can then be installed at the operator's convenience, without shutting down the equipment.

The liquid service type, illustrated herewith, interposes the rupture disk between the vessel protected and the pop valve, thus protecting the latter from gumming up or from corrosive attack. Should over-pressure occur, the disk ruptures after which the valve opens, relieving the excess pressure. When the pressure has been reduced to that for which the valve is set, it closes, permitting operation to continue. A new safety head is then installed when the vessel is taken out of service.

These units are made in sizes ranging from ½ to 1½ in. for pressures up to 500 lb.

Industrial Humidistat

FEATURES suiting it for use where dust, dirt and other adverse service conditions would prevent the satisfactory operation of other types are claimed for a new insertion humidity control recently announced by Julien P. Friez & Sons, Division of Bendix Aviation Corp., Baltimore, Md. The new control employs this company's multiple human hair element and a switch mechanism fully inclosed in a molded plastic case. Control of both humidifying and dehumidifying is provided over a range of from 10 to 100 per cent relative humidity, with a sensitivity of plus or minus 1 per cent.

New Pump Design

WORKING TOWARDS its aim of having available ultimately a complete line of Amsco-Nagle vertical and horizontal centrifugal pumps for handling all types of abrasive mixtures and corrosive liquids, the American Manganese Steel Div. of American Brake Shoe & Foundry Co., Chicago Heights, Ill., has recently introduced five different new designs, some horizontal, some vertical. The accompanying view shows a cross section of the new Type SW vertical-shaft pump. Motor, coupling, thrust bearing and housing are supported by a reinforced plate which serves as a structural member. The right-hand strut serves as a conduit for lubricating the lower bearing. An inverted intake is used to avert gas binding and to utilize the hydraulic thrust to counterbalance the weight of the revolving parts. Various designs of impeller, both open and shrouded, are available. Many different ferrous and non-ferrous metals and alloys may be used for the parts subject to abrasion or corrosion.

CHEM. & MET. REPORT ON

Maintenance in Process Industries

TO PLANT MANAGERS, SUPERINTENDENTS AND CHEMICAL ENGINEERS

Maintenance is always an essential function in the process industries. Now that defense demands threaten to put a still heavier load on equipment and personnel, even greater emphasis will have to be placed on the prevention of breakdowns and the conservation of machinery of all kinds. To help you develop an efficient maintenance organization, or improve the organization you now have, we asked several questions of a group of industrial executives, each in a different process industry, relating to the maintenance organization, philosophy and methods of procedure employed in their respective companies. The answers will be found in the five articles appearing in the following pages.

CHEMICAL & METALLURGICAL ENGINEERING

December, 1940 Series A, No. 8

TITLE OF REPORT Maintenance in Process Industries

TO Plant Managers, Superintendents and Chemical Engineers

FROM Chem & Met Contributors

DATE December, 1940

Organization of Maintenance In Process Industries

INTRODUCTION

Surveying the list of problems which are likely to come to the fore as plants are thrown into high gear for the defense effort, *Chem. & Met.* Editors came to the conclusion that conservation of existing equipment, and increase in the efficiency of the personnel that must care for it, are likely to prove of extreme importance if the usual course of earlier periods of intense national effort is followed. On the one hand, processes will in many cases be operated at more than normal capacities, so that the wear and tear on plant of all kinds may be expected to accelerate. On the other hand, shortages of necessary construction materials are almost certain to develop, while equipment manufacturers will find that their delivery dates are necessarily pushed farther and farther into the future. Meanwhile, interruptions to production will become increasingly unwelcome, so that their avoidance will be a prime problem of management, technical personnel and labor alike. All of this means a need for better maintenance, not so much in the actual manipulation of the tools of the repair mechanic, but in the organization and philosophy of this essential function.

SUMMARY AND CONCLUSIONS

To the end, therefore, that management and the engineers responsible for maintenance in process industries plants should be able to re-appraise their own methods in the light of those used by others, *Chem. & Met.* asked authorities on maintenance in five different process industries a number of questions which are answered in the following articles. They were asked what types of maintenance problems they encounter; how they regard maintenance in relation to the entire production problem; what method of organization for maintenance had been found most effective; what sorts of work in addition to maintenance were carried on by the department; and what means were used to anticipate breakdowns and extensive repairs.

As would be expected, not all of these authorities are in complete agreement at every point, for requirements differ at various plants, even in the same industry, whereas these examples were picked from different industries. In some plants, for example, maintenance is one function of the same engineering department which handles all engineering problems for the plant. In others, maintenance reports directly to the plant management, or to an engineering department which is responsible only for certain types of engineering functions.

Some of the plants use the maintenance department for much design, construction and erection of new equipment and buildings, while in others this function is handled to a considerable extent either by other departments, or by outside contractors. In all cases, however, at least some new construction is handled by the maintenance group.

The similarities are particularly striking. There is general agreement that most effective maintenance results where red tape is cut to a minimum, and where as much authority as possible is delegated to the maintenance men themselves. Good tools and good training are considered essential. Last but not least, preventive maintenance, the anticipation of trouble by routine inspections and repairs, is generally practiced, although not to the extent by some that it is by other plants.

Diversified Repair Problems In Chemicals Manufacture

W. E. MILLER and B. F. KING

Respectively Superintendent and Assistant Superintendent of Maintenance
Carbide and Carbon Chemicals Corp., South Charleston, W. Va.

MAINTENANCE DEPARTMENT work in the plant of Carbide & Carbon Chemicals Corp. at South Charleston not only includes the traditional functions of upkeep of machinery, property and equipment, but also the construction and installation of new machinery as well as the alteration and rearrangement of that already in use. These added functions are a direct consequence of the far-from-static conditions that obtain in chemicals manufacture. Rapid changes are common, and specially designed equipment and machinery are often needed, which must be installed together with the necessary piping. Similarly, many alterations in existing equipment and piping must be made to accommodate changes in processes, a fact which is particularly evident in the case of new developments which may be partially experimental and subject to change or improvement after commencement of operations.

Nearly every kind of maintenance encountered in the process industries is found in the South Charleston plant and the number of different trades composing the maintenance department is therefore large. Also, the size of the department is numerically great, requiring a total of over 300 men in spite of the fact that not all maintenance functions are handled through the department. Several independent organizations work in harmony with the regular maintenance group, but are not responsible to the superintendent of maintenance or his organization. Included among these are the instrument department which selects, installs and services all instruments; the yard crew which maintains the yard, grounds and railroad trackage; the process safety department which establishes and conducts tests on process equipment; and the salvage department which reconditions and stores used equipment, pipe and fittings. In addition, the operating department has a crew of several men working on each shift who perform minor routine and emergency work; and a number of day maintenance crews for routine servicing and inspection which are responsible only to the various operating department heads.

All the remaining functions of maintenance including operation and maintenance of trucking, plant mail, bus and passenger car service, and company-owned tank cars, are the responsibility of the regular maintenance staff.

Owing to the large amount of territory taken in by the plant, part of it being on an island in the Kanawha River, several of the divisions of the maintenance department are split into two groups, operating from a number of different shops. The entire department is responsible to the superintendent of maintenance, who is assisted by the assistant superintendent, and under whom are three general foremen, several group foremen and a number of sub-foremen, or pushers. Also reporting to the heads of the department is the maintenance engineering division, composed of graduate chemical, mechanical, civil and electrical engineers and numbering about a dozen men.

On account of the splitting of some of the divisions such as the pipefitters, riggers, welders, sheet metal workers and blacksmiths, doubling up of the supervision is required for a part of the department.

Among the trades of which the maintenance department is composed are machinists, mechanics, electricians, pipefitters and pipe machine operators, riggers, oxy-acetylene and electric welders and lead burners, boiler makers, blacksmiths and hanger men, carpenters, insulators, painters, tool clerks and laborers. Also included are the automotive mechanics, drivers and "expediters" whose job is to maintain the automotive equipment and expedite the movement of men, mail and materials in intraplant traffic.

To care for emergency work outside the day shift, the department maintains besides the regular day shift crews, a 24-hour crew of electricians and mechanics, each consisting of one first class man and a helper. In addition, the regular maintenance crew is on call for overtime work at any time within the 24-hour period, if such work is required. To utilize the machine shop equipment to best advantage, an evening shift crew of machinists and helpers is maintained, together with one welder.

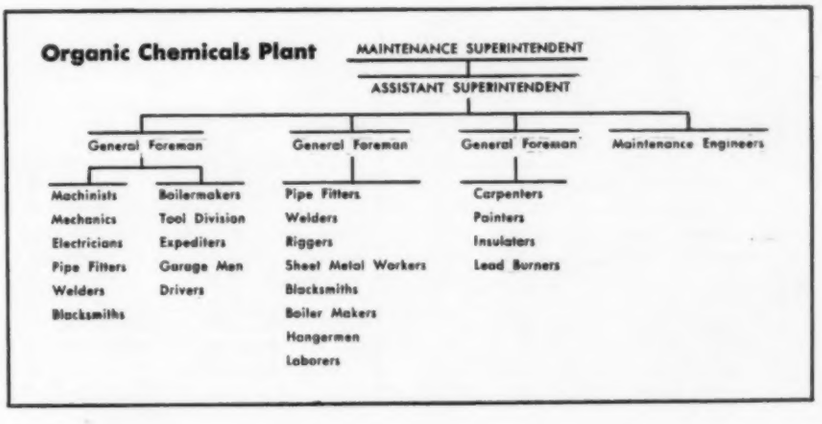
The machine shop at South Charleston, as is typical of chemical plant shops, is set up to handle an extremely complex variety of work. Many unusual problems are encountered requiring a high degree of experience and ingenuity on the part of the personnel. A large number of modern machine tools are on hand for such diverse work as building heat exchangers, rebuilding any kind of bearing, protecting or rebuilding a pump shaft by metal spraying, or making molds for plastic resins.

All mechanical work in the field, except that on compressors, is handled by the field mechanics division. The plant contains more than 25 different types of mechanical equipment. Owing to this diversity, the division is broken down into groups of specialists on certain broad equipment classifications. So many compressors and vacuum pumps are used in the plant that a separate group of mechanics has been developed to work exclusively on compressor maintenance.

With more than 1,000 miles of pipe of all sizes employed in the plant, the duties of the pipefitter are many and varied. Men of this trade specialize to some extent, perhaps on alloy work, or on high pressure piping or other classifications, but all can cover the entire field if occasion should arise.

Much moving of heavy equipment is required so that a large and well-equipped crew of riggers is necessary. The same is true of the welding department. As one of the first chemical plants to employ welding extensively for both piping and equipment, Carbide requires many specialists both on oxy-acetylene welding and cutting, and on electric welding. A separate shop is maintained for the lead burners who have jurisdiction over the many thousands of tons of sheet lead and lead pipe in the plant.

None of the maintenance divisions encounters a greater diversity of work than the electrician group which is responsible for the proper functioning of the electrical equipment in the two



powerhouses, 15 substations, many switchboards and more than 2,000 motors, among numerous other sorts of electrical apparatus. Fabrication and repair of the large number of heat exchangers in the plant is in the hands of a group of mechanics known as "boiler makers". Tool making, the construction of pipe hangers and the forging of numerous machine parts and structural steel shapes are handled by the blacksmith shop. Thin gage sheet and galvanized iron and copper are fabricated and maintained by the sheet metal workers who also take care of "non-bonded" roofs and fabricate gear, belt and coupling guards, ductwork and numerous other items.

Concrete forms, wooden roofs, buildings and sheds, bottle crates, cabinets and other wooden construction or repairs are in the province of the carpenter shop. This trade also maintains window glass. The paint shop, primarily concerned with keeping ahead of corrosion, tests and checks numerous paints and keeps the plant ship-shape. An insulation department selects, installs and maintains heat and cold insulation for all insulated equipment and piping.

Finally, integrating the work of the previously mentioned trades is the tool division, which procures and maintains an adequate supply of tools of all kinds, keeping them at strategic points for issuance as required. A factor worth noting is the predominance of pneumatically operated tools among the powered varieties, since electric tools cannot be employed outside the shop for safety reasons.

In many phases of the maintenance problem, preventive maintenance is standard practice. For example, automotive equipment is regularly washed, serviced and checked. All tools are inspected upon return and power-operated and pneumatic tools serviced regularly. Motor bearings are inspected on schedule, as are other types of equipment, such as the motors themselves, motor starters, stuffing boxes, flexible couplings, conveyors and transmission belts. Motors are torn down on regular schedule and their electrical parts tested, cleaned, dried, dipped and baked.

Informality Favored in Sugar Mill Work

DAN GUTLEBEN

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Philadelphia, Pa.

THERE is advantage in the compactness and informality of the small-plant style of organization where the department is designated by the first name (or nickname) of the foreman. When the "Old Man" organized operation of the plant nearly 30 years ago, he attracted a small crew and worked with them shoulder to shoulder. As the works grew, the personnel extended but the style remained. The "Old Man" is president now and likely as not, as he walks through the plant, he will stop for a chat here and there and bum a chew from the family plug.

Maintenance is not singled out as the special field of a special department. The design, construction and operation provide the cause for maintenance. It is a nuisance, a source of loss and sometimes the reason for operating interruptions. Therefore the same men who are concerned with the design and construction are also charged with "R & M". Maintenance is projected into the foreground along with design and capital cost. The mechanics who build and operate also repair and maintain and thus acquire a balanced notion of the cause and effect. The engineer's office supervises the conduct of maintenance, but actually when a pipe fitting crew needs help from the machine shop, or the millwrights, or the riggers, they go and get it without authorization from the engineering department, unless a conflict should arise as to priority. And even this is usually settled by the key men themselves according to the importance of the apparatus.

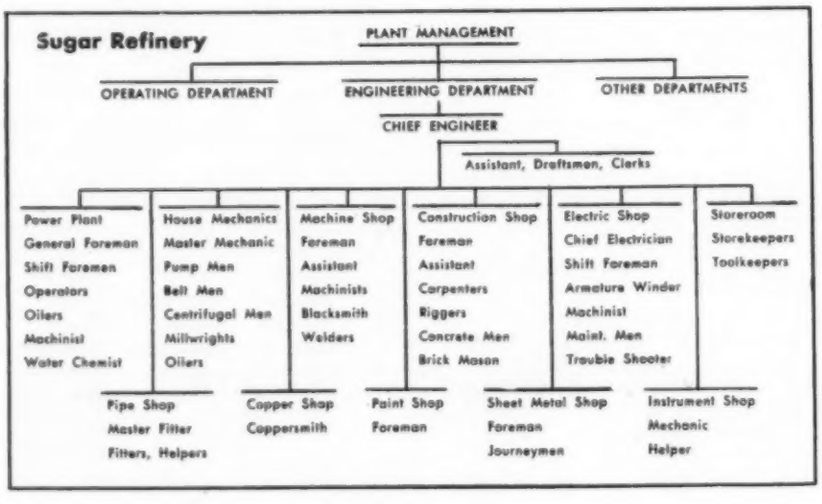
"Old John" philosophizes that a task that he performs of his own initiative is "twice as easy". Under this idea the rein is held loosely and the men have developed judgment and cooperative instinct. Everybody knows that a breakdown that may affect production gets first call.

Design has an important and predictable effect on maintenance. A still or a tank which has been designed only for structural sufficiency may lose a sixteenth of an inch in 12 years. By that time the factor of safety is gone and during the past few years repairs have become troublesome because of the thinness of the metal. If the constructor had added a sixteenth beyond the structural needs, then at least 12 years of operation would have been trouble-free and the expectancy would have extended to 24 years.

As the plant grew, power transmission devices became as various as their number. A standard specification was set up 15 years ago and as old drives failed, new ones of the new standard took their places. All drive chains for instance are manufacturers' standard steel roller chains available everywhere. The sizes used, outside of the small package machinery, are 1, 2 and 2½-in. The sprockets are few in size and the numbers of teeth are multiples of six between 12 and 84, identifiable at a glance. Shafts also are few in sizes and all bearings are anti-friction, built within a half hour's run from the plant. Gear reducers too are standardized so that one spare in the storeroom can pinch-hit in many places in the plant. Motors are usually of a standard make so as to have standard shaft diameters and speeds.

Conveying machinery submits to standardization of certain parts. The head shafts and drives of four raw sugar elevators and two wet sugar elevators are exactly alike. The storeroom spare plus a couple of hours' time, day or night, take care of this item in case of failure.

There are about 150 water and liquor pumps in four sizes, all of one make and interchangeable. The casings are large enough to permit a considerable range of impeller diameters. For each size of pump, spare shafts are stored with varying sizes of impellers. In those cases where no outage is permis-



sible, two pumps must be installed, but if an interruption of a half hour can be allowed, then a single standard pump is used. In case this should fail without warning, a spare can be set over the same foundation bolts and be ready for service in a half hour's time. Most of the pumps are bronze. As the cast iron casings wear out, they are replaced with bronze. Worn bronze casings are easily built up by the aid of the electric welder.

The house mechanics repair and maintain and when there are no urgent jobs in this line they erect new equipment. The machine shop always has a back-log of new parts and special machines to build. It is equipped with a versatile master machinist and a full complement of machine tools including a turret lathe, universal miller, automatic shaper, horizontal boring mill, grinder, vertical keyseater, various engine lathes, drills, 150-ton press, hand-operated traveling crane serving the entire floor area, a highly skilled blacksmith with power hammer and air press (drill sharpener) and finally seven portable electric welding machines which float around the plant. Every mechanic is urged to acquire the rudiments of electric welding under the master machinist as instructor.

As to structural steel and other building details, the cost of maintenance is largely in the hands of the builder. If he does it "well enough to last as long as we're here," his successor will have a continuous battle. Structural steel hidden behind porous brick continues to rust. The third coat of paint costs less than the first and may double the life. Waterproof sills in brick walls do a lot of protecting for a small price. Galvanizing of steel sash or three coats of the best quality of paint, especially on the hidden surfaces, starts the job off right and makes maintenance easy.

The sheet metal shop in recent years has been able to devote itself mostly to new work since improved design of bins together with electric vibrators have reduced the sledge hammer abuses formerly administered. The aim of manufacturing technique is to reduce the man-hour input in proportion to the rise in price per hour so as to avoid causing pain to the customer by price boosts. This is followed also in maintenance and repair. The maintenance men are reducing their own hours by improving the machines and methods.

An informal organization does not tend to fit neatly into the pockets of an organization chart. However, to conform to convention, an approximation is appended, showing how the engineering functions of the plant head up in the engineer's office under the Engineer, his Assistant, Draftsmen and Clerks. The names on the chart proclaim the duties. Sometimes crews double up for emergency jobs and may also be augmented from the operating force.

Foreman Authority Stressed At Glass Works

A. VAKSDAL and F. S. KRIGER

Respectively Plant Engineer and Assistant Plant Engineer

Corning Glass Works, Corning, N. Y.

INCREASE in the tempo of American industry is bringing new problems to maintenance groups. These problems, if successfully solved now, will act as insurance against shutdowns in the coming months when continuity of production will be so important.

One of the outstanding problems is the handicap of loss of personnel and the need to retain efficiency regardless of losses. With trained men becoming scarcer each day the maintenance department offers a reservoir of trained personnel which is tempting to production departments. Losses through conscription and voluntary enlistments will still further reduce maintenance forces. Increased production hours, machinery used to full capacity, and new expansion will increase maintenance volume. Rising wages will tend toward increased costs. Maintenance departments must, therefore, train men rapidly and must use every available means to improve their efficiency.

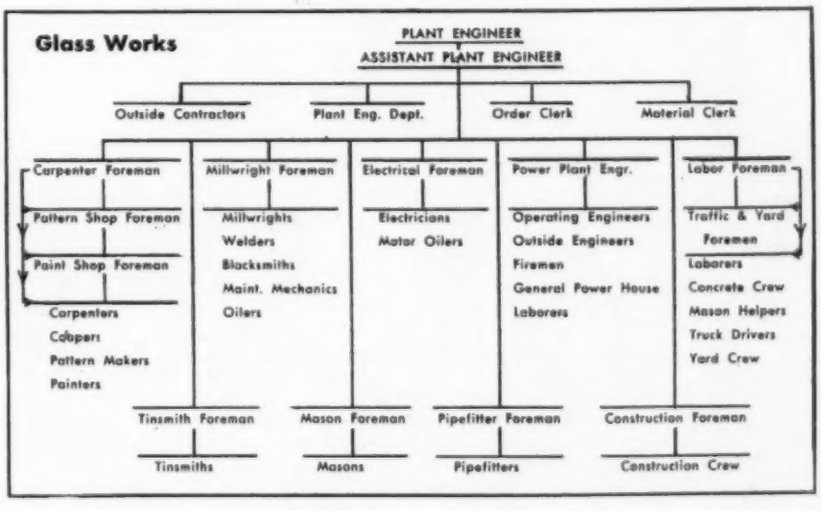
This problem of personnel can be met by the more careful selection of men and by the early training in the various trades of likely looking men through placing them as helpers with older and more experienced crews. Boys who have shown mechanical aptitude in high school are quick to learn, and moving them from one mechanic to another on a variety of work soon gives them a working knowledge of the trade which can be developed as rapidly as the boys' native ability allows.

Maintenance employees can be brought to surprising peaks of efficiency by seeing that proper equipment is available. Small power driven portable tools that can be carried to the job, instead of bringing the job to the tools, make for better work in less time. Substitution of new materials and methods for old ways saves material and labor costs. Job planning, so that materials are available when needed, and so that various trades are coordinated on the job at the proper time, saves hours. Jobs planned ahead and scheduled, so that each man knows where he is going next, saves time lost between orders.

Continual and constant inspections of equipment catch breakdowns before they occur and anticipate the ordering of necessary parts, again saving many hours of lost production.

Foremen with responsibility must also have authority and initiative in order successfully to carry on their assignments. It is a waste of time and effort, besides being an annoyance to a production foreman, to have to go to the trouble to write an order for a leaky roof, a burned-out light bulb, a blown fuse or a dripping faucet. At Corning, individual trades foremen are answerable for this type of occurrence and are at liberty to make routine repairs when they best fit their work schedule. Furthermore, it is their duty to note the need for such repairs as they are required, through routine inspections and checks, without having others call it to their attention.

More costly repairs, however, require engineering department authorization. For example, if a roof must be replaced, if a circuit is overloaded and additional copper or transformers are required, the plant engineering department is available for advice and



further authority. Otherwise, the responsibility for maintenance is the foreman's and his alone. No orders are required to get a lesser job done and no outsider tells him how to do it. A constant stream of minor orders show that the foreman is not accepting this responsibility.

Our maintenance organization works on the theory that the smallest amount of red tape gets the best results. The plant engineering department, which is responsible for all engineering work except the development of new glass making machines, and glass and mold design, supervises the maintenance department, as shown in the accompanying organization chart, but encourages the individual maintenance foremen to assume complete responsibility for their respective divisions as far as possible. In the province of the maintenance department is the work of caring for repairs on all buildings, mechanical equipment of buildings, plant roads, protection, general plant machinery not maintained by individual departments, and electrical equipment, service and lines. Unless the volume of work requires calling in outside contractors, the department also handles new construction of both buildings and equipment.

Each trades foreman controls his own group, cooperates with the other groups and looks toward the plant engineering as an advisory and consulting service. On major projects or those of a technical nature the plant engineering office does the design, estimating, ordering of material, and follows the job in the field. As noted, on smaller projects the foreman has full responsibility and he in turn often delegates individual assignments to individual or group leaders within his own division. This further develops, as far as possible, a sense of responsibility in each employee and a personal pride in his work and skill.

Planning and scheduling maintenance is always a difficult problem. Close cooperation among the foreman requesting the work, and the ones doing the work, must be maintained. The maintenance foreman cannot always work on a machine at the time that best suits him or serious production losses may result. On the other hand a production foreman who demands that work be done nights, Saturday and Sundays, often incurs only the expense of overtime work.

Orders for all classes of work are issued on one general form. The production foreman or other authorized person writes an order on the plant engineering department for the work. All orders pass through a central order clerk who makes a copy for each trade foreman involved, attaches necessary blue prints, parts lists and other pertinent information, and issues them to the correct trades foremen after approval by the plant engineers.

Upon receipt of his orders, the foreman sorts them out in order of importance and assigns them on the division scheduling board to the employee or group within that division who in his judgment can best do that job. The scheduling board shows at all times, for each employee, the job working, the jobs finished that day and the orders waiting. Each employee has his own job card for each order which is rung on the clock when work starts and stops. The card carries the charge account, job description and location, and serves both as a time record and job cost record when it is forwarded to the cost office. Work orders, when completed, are marked by the foreman and returned to the order clerk for filing.

With direct and indirect costs constantly on the upgrade, with industry becoming more highly mechanized and requiring more maintenance, one maintenance department has succeeded as indicated in keeping production free of interruptions and has given aid in every possible manner to increased general manufacturing efficiency.

Good Organization Essential In Pulp Mill Work

VINCENT F. WATERS
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New York, N. Y.

MAINTENANCE in the pulp and paper industry differs from other industries in many respects and in no industry is there a greater demand for continuous, uninterrupted operation. The mills operate 24 hours a day and usually for five to six days per week. Even in the shut-down period some equipment, such as the power plant and prime movers, continues in operation.

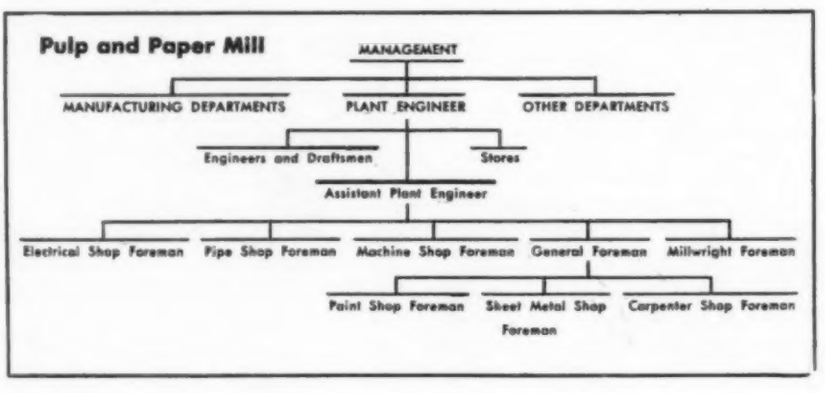
The plant engineer is responsible for the maintenance organization, as well as for the engineering department. The assistant plant engineer generally oversees any major repairs and new installations. The engineers and draftsmen lay out plant improvements, design equipment, and sometimes supervise repairs, rebuilding of equipment, and new installations. Each of the maintenance divisions is under a foreman or chief, who is responsible to the plant engineer, from whom written orders are received for work to be done.

Each manufacturing department is supplied with tour (shift) electricians, pipefitters, and millwrights who may be called upon at any time by the foremen of manufacturing departments, without written orders, to take care of minor repairs or adjustments.

First and foremost in the solution of plant maintenance is building up a plant organization that will work in harmony with the management. Careful selection of men and an outline of specific duties is essential. Plant operation and maintenance must go hand in hand. In many cases the operator makes minor adjustments. More serious defects, however, must be reported to the foreman, whose duty it is to notify the tour maintenance man or send a request to the engineering department.

Duties of the maintenance men are extremely varied. Take the case of the electricians: Inspection of equipment is a regular function of the tour electricians. Electricians are responsible for the efficient operation of motors, generators, automatic controls, electric lighting systems, power wiring systems, communication systems, elevator equipment, fire-alarm systems, time clock systems, and all electrical parts of machinery, instruments, and so on.

In electric motor maintenance the electrician must know how to test and how to dip and bake motors. He must know when it is necessary to change bearings, how much end play to allow, and what clearance to give new bearings. He must know how to make wiring diagrams and how to assemble



and connect coils. He must be able to check the load of a motor and change motors to fit the load. In wiring he must know what size and kind of wire to use for various purposes, the kind and size of insulators, when to use conduit. He must understand the principle, cleaning and repair of transformers.

The head oiler should know the types of bearings and the kinds of oils required. He must know proper running temperatures and when water is circulating properly through water-cooled bearings. He must recognize ordinary causes of trouble, and understand how to break in new or overhauled machines. One of his jobs is to make simple physical tests of oils and grease.

Thousands of feet of pipe made of various materials are used in the plant, the service conditions of which vary widely: some acid, some alkaline, some extremely corrosive, some practically noncorrosive, and so on. The pipefitters are responsible for the installation, maintenance and repair of all these pipes and must be able to figure layouts of systems, read blueprints, and determine length of pipe. The pipefitter must be able to repair liquor heaters, digester and diffuser leaks, liquor tanks, liquor screens, blow valves, liquor valves, steam valves, and pipes in the digester room.

The machine shop is an important department in the maintenance organization. Its equipment includes milling machines, boring mills, shapers, planers, lathes, etc. The machinist may be called upon to work on the most delicate instruments, or to machine large pump castings. He makes rolls; shafts for motors, pumps, winders, etc.; bearings; and many other items. Parts for new machines or broken parts for old machines may be made or repaired in the machine shop.

Work of the carpenters includes repairing all wood tanks or vats and making boxes for shipping paper and other materials as required. They make forms for concrete, patterns for castings, and all similar work. The painters paint buildings and equipment, inspect painted surfaces and take care of special jobs, for acid, alkali, and heat resistance. The sheet metal workers construct tanks, ducts, and the like. In the paper mill large volumes of air are moved and the sheet metal shop is called on for the construction, installation and maintenance of many hoods and ducts.

The millwright's job is one of wide diversification. From the woodyard to the shipping room, there are conveyors of all kinds and sizes, to be maintained in first class condition. He may be called on to file saws, grind knives, adjust bearings and drives. He may have to repack a pump or valve, or repair or adjust a knotter or a flat screen in the digester or screen rooms. He must understand the beater, its adjustment and its operation. He must know when bearings need rebabbiting, cleaning or lining up, and how to do these jobs.

He must also be able to disassemble and re-assemble the jordans. On the paper machine he must be able to set doctors and properly align the presses. In the dryer section he must adjust rolls and guides and adjust takeup on belts. On the calendar stacks he must check alignment and adjustment, know how to remove the rolls and adjust the bearings.

The belt repairmen, who are under the chief millwright, make splices in leather and rubber belts; replace broken hooks; install new belts and adjust belt tension. A belt repairman must know the normal running tension of all belts, how to detect defects, when a belt is no longer serviceable, what size and kind of belt to use, and how much tension to put on a belt.

Routine handling of say a new pump installation is as follows from the maintenance department's view: a job number is set up for the job, and circularized to all departments involved, including the cost department. All requisitions which are issued for material for the job are given this job number. The workmen then make out time slips and charge their time for the job against the job number assigned. As soon as the pump is in satisfactory service, the job number is eliminated and the cost department determines all the costs and sets up a sheet for depreciation and record purposes.

There are regular job numbers which are never changed. These are used for repairs and adjustments. A maintenance man called to pack a valve or do other routine work merely identifies the department, work done, and the time required on his time slip. If materials are required he usually obtains the requisition from the manufacturing department foreman.

Each jordan, digester, beater, motor, or other piece of equipment, as well as each building, is given an identification number. The number on a motor or other piece of equipment is its identification from the time of its purchase until the time it is discarded. A card record is kept for each piece of equipment and the cost for repairs is entered on this card. The costs and charges to individual machines, buildings, etc., are made by the cost department so that accurate data on the maintenance of any piece of equipment are available.

Preventive maintenance is the work done to maintain the equipment of a plant rather than to allow it to become defective or break down, causing loss in production. This requires the scheduling of adjustments, replacements and inspections. At regular intervals each motor, machine, or other piece of equipment must be inspected, minor adjustments made, and any unusual condition reported.

Avoiding Breakdowns In a Coke Plant

F. D. LOHR

Superintendent, Koppers Co., Seaboard Div.
Kearny, N. J.

SAFETY ENGINEERS say "Accidents don't happen, they are caused." The maintenance engineer, paraphrasing this, states "Breakdowns don't happen, they are caused." Believing this he builds up his maintenance organization on the theory that proper preventive maintenance can keep breakdowns at a minimum. The maintenance organization of the Koppers Co., Seaboard Division, at Kearny, N. J., is based on this premise.

The plant at Seaboard is a typical byproduct coke oven installation. A brief review of its operation is given as a background to the discussion of the maintenance problems which it has. The 3,000 tons of coal it processes each day are unloaded from 10,000-ton steamers and carried on conveyor belts to the stock pile or to the preparation building where the coals are crushed and mixed. From there the coal is taken to the storage bins at the coke ovens. It is charged into the ovens and coked for about 15 hours. The red hot coke is then pushed out of the ovens, cooled, sized and loaded into boats, cars or trucks for delivery to the customer. The gas is purified by the removal of the tar, ammonia (as ammonium sulphate), light oil (crude benzol, toluol and xylol), hydrogen sulphide, etc. Some of the gas is used for heating the coke ovens. The greater part, however, is sold to the local gas utility for distribution.

From this brief outline of the operation of a coke plant it can be seen that the maintenance problems fall into three general classes: (1) Materials handling; (2) high temperature; and (3) chemical.

Materials Handling—These problems are tied in with the maintenance of unloading towers, coal bridges, conveyor belts and coal and coke crushing equipment. When coke is being handled and sized, there is the added problem of abrasion. Among the more outstanding problems have been the

determination of the proper material for chute lining, the most economical steels for coke sizing screens, and the most suitable types of conveyor belts to be used for coal and coke. The recent development of the use of oil on coal and coke for dustproofing has added another factor to the belting problem.

High Temperatures—Coke ovens are high-temperature furnaces built of silica brick. They are built in rows, commonly called batteries, with a common heating wall between each oven. The plant at Seaboard consists of three batteries of 55 ovens each. The ovens are approximately 40 ft. long, 18 in. wide and 10 ft. high. The temperature in the gas-burning flues in the heating walls runs at least 2,500 deg. F. and the temperature of the coke when pushed is approximately 1,800 deg. F.

Constant attention to minor repairs is necessary for the maintenance of this enormous mass of hot masonry. If these are conscientiously carried out, it is hard to guess the probable life of a coke oven battery. The ovens at Seaboard have been in continuous operation for more than 23 years and are still in first class condition. There is a constant search for new high-temperature repair materials and methods in order to increase the efficiency and lower the cost of the routine maintenance which is always being carried on.

Chemicals—The processing of the gas at Seaboard involves treatment with fresh and salt water, acids and alkalis, which means that the coke plant faces all the attendant problems of corrosion, correct use of materials, etc. Here too is the ever present problem of the improvement of materials, equipment and methods in the handling of different types of chemicals mentioned.

In addition to these three types of maintenance problems there is the common one of the maintenance of buildings, structures and standard equipment such as steam turbines, pumps, motors, boilers, etc. In this connection the question as to where the design, painting and maintenance of buildings and structures pass the needs of utility and become matters of decoration is a point of fine distinction and a cause of much argument and discussion.

The development of a repair organization to handle the problems outlined was greatly influenced by the fact that a coke plant is a continuous operation running 24 hours a day and 365 days a year. Of course, spare equipment is provided in many instances. On the other hand, at many places, such as key conveyor belts, it is not practical to provide a spare. There is always enough flexibility in plant operation so that by re-arranging the flow of material a shut down of almost any part of the plant can be had for a limited time. It can be seen, however, that close cooperation between the operating and maintenance departments is absolutely necessary.

ORGANIZATION CHART

The maintenance organization for Seaboard is shown on the chart. It can be broken down into several general groups:

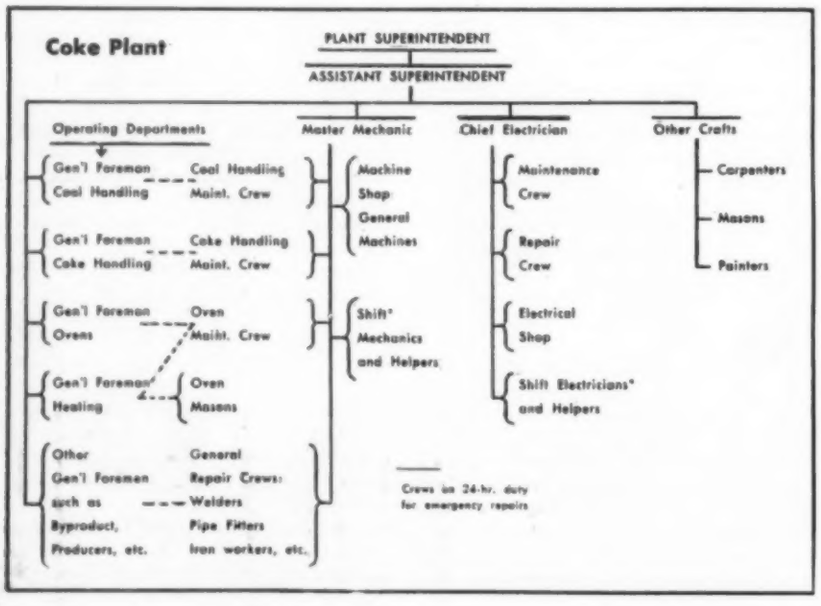
First, there are a number of maintenance crews consisting of a working foreman and several mechanics. Some of these are permanently assigned to certain operating departments. Others are moved from one department to another as the need arises. The departmental general foreman is held responsible for the maintenance work in his department. It is up to him to line up what jobs are to be done and, equally important, *when* they are to be performed. To this extent, the general repair crews report to him. On the other hand, the master mechanic is responsible for *how* a job is done. He hires, trains, transfers and promotes the members of the repair personnel. He and the departmental foremen work together on the development of new repair methods and materials.

Backing up these field crews is a general machine shop organization consisting of mechanics, blacksmiths, lathe hands, etc. The size of the machine shop organization varies from plant to plant. At Seaboard it has seemed profitable to do the majority of the larger repair jobs in the Seaboard shop whenever possible. There is no general answer as to how much work should be farmed out, since local conditions result in different answers at different places.

Finally, there are other independent maintenance groups such as electricians, painters, etc. They also have to fit their work in with the operations of the department which is calling for their services. The same policy holds in these cases, namely, the operating head is responsible for *what* and *when* and the maintenance head is responsible for *how*.

The cost accounting set-up at Seaboard is briefly as follows: Normal repair labor and materials are charged to the operating department which incurred the expense. Formerly these departmental expenses were again subdivided and charged to various pieces of equipment in the department. As a background of experience over a number of years was built up, it was found that these subdivisions could be combined and simplified because normal repair costs did not vary much from one year to another. In order to catch the extraordinary expenses a "Work Order" system is also in effect. A work order is issued for any unusual repair or construction expense, and must be approved by the plant superintendent as well as the department head before the work is started. All labor and materials are charged to the work order and the total cost of the job determined when the job is completed. In some instances certain routine repairs are also covered by a work order where it has been found desirable to keep separate costs on these items.

To summarize, the operation of a coke plant means a continual battle against the forces of abrasion, corrosion and high temperatures. Hence, alert preventive maintenance is necessary to eliminate costly breakdowns. The continuous nature of the operation makes close cooperation between the operating and repair departments necessary and the organization at Seaboard has been developed on this basis.



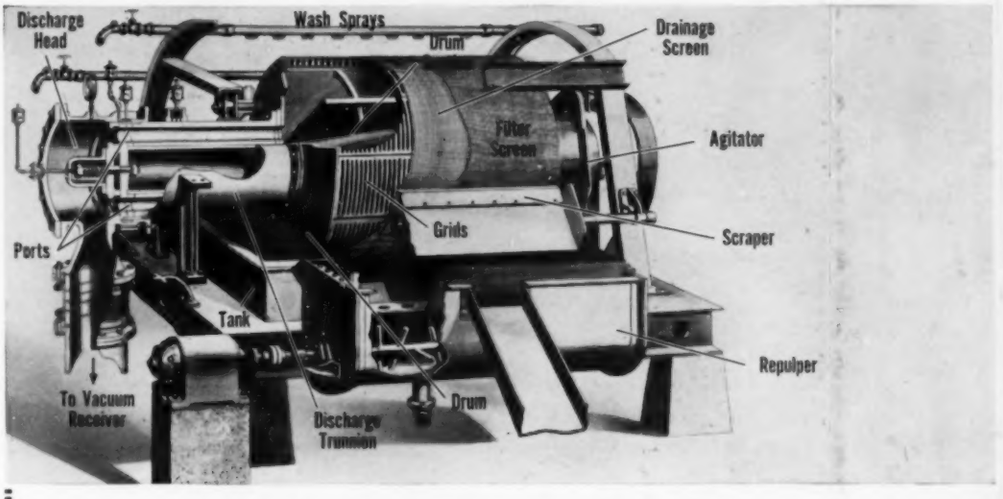
Reprints of this 8-page Report are available at 25 cents per copy. Address the Editorial Department, Chem. & Met., 330 West 42nd St., New York, N. Y.

FACTS YOU NEED TO KNOW ABOUT...

Rotary-Drum Vacuum Filters

For filtering and washing practically all solids except colloidal or very coarsest granular materials

The rotary-drum vacuum filter is best suited for filtering solids that are easily kept in suspension by mechanical agitation. These include finely divided solids that settle readily and crystalline solids having a specific gravity near that of the liquid. By far the most filtration problems come under this classification.



PRINCIPLE OF OPERATION

Feed enters the tank and the solids are held in suspension by an agitator. As the drum rotates through this slurry, liquor is sucked through the filter screen, while the solids remain on the drum surface as a cake. This filter cake passes through the initial drying section, then under sprays of wash water, and then through the final drying section. It is finally removed by a scraper assisted by a light blow-back of air. Dewatered cakes may be discharged direct or to a repulper. The filtrate and air pass into the drum sections, then through ports in the discharge trunnion, thence into the discharge head, and finally into a receiver.

ADVANTAGES

High Capacity—The rate of filtration of any filter is very high at the start and diminishes as filtration progresses. Because of the short filter cycle of the rotary-drum vacuum filter, high capacities are always obtained. In the best designs, the initial cake is formed under low vacuum, which helps to eliminate cloth blinding and allows the use of a more open filter medium—thus further increasing over-all capacity.

High Washing Efficiency—In general, the uniform cake formed by a rotary-drum vacuum filter, coupled with the uniform application of wash water, results in high washing efficiency.

Low Operating Costs—Since the rotary-drum vacuum filter is entirely automatic, as many as 8 or 10 can be handled by one operator, who need not be highly skilled, thereby avoiding high labor costs. Maintenance cost is low, since speeds are slow.

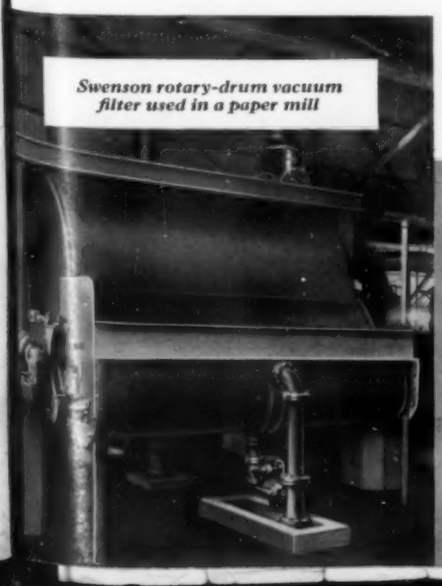
LIMITATIONS

There are some applications to which the rotary-drum vacuum filter is not well suited. For example, with very coarse granular materials that settle very rapidly, it is difficult to maintain a uniform suspension by mechanical agitation. Such materials are much more economically handled on the top-feed filter, especially when complete drying is required. With slow-settling solids of a colloidal nature, or if polished filtrates are necessary, the pressure filter is recommended.

TYPICAL APPLICATIONS

Rotary-drum vacuum filters are used extensively in the production of many materials. Among them are Glauber's salt, vacuum pan salt, caustic salt, lime sludge, zinc sulphate, flotation concentrates, potassium carbonate, copperas, Steffens process sludge, starch, cement, and blast furnace flue dust.

SWENSON offers a complete line of rotary-drum vacuum filters, in a wide variety of materials, including lead, nickel, stainless steel, and Everdur. Write for new bulletin, "Efficient Filtration at Low Cost."



Swenson rotary-drum vacuum filter used in a paper mill

SWENSON EVAPORATOR COMPANY

Division of Whiting Corporation • *15669 Lathrop Ave., Harvey, Ill.*

SWENSON

FILTERS

EVAPORATORS • CRYSTALLIZERS

3 P.M. SHUTDOWNS

A Case Where Too Much Steam Made Trouble

SOLVED WITH PREVENTIVE MAINTENANCE

"YOU'LL have to shut down at three today," the Superintendent of a northwestern wood-working plant said to his shop foreman. ". . . Kiln's tied up again with heating trouble!"

The plant was swamped with orders—like many another shop today. And repeated valve trouble in the steam line at the kiln meant falling farther behind on deliveries.

Preventive Maintenance was the only answer. For it's the only way of solving piping problems permanently. Yet, Preventive Maintenance is a simple technique—just a matter of *being sure* the installation is right, and the valves and fittings the best for service conditions.

The Superintendent saw the waste in ordinary repair—he called in H. E. O., the Crane Man. His wide experience would help to remedy the trouble quickly and surely.

Here's what the two men found: Steam was piped from the boiler with a four-inch line equipped with a four-inch pressure-reducing valve. And there was the source of the trouble! The valve was much too large. It couldn't operate properly at the low pressure setting required. Severe wire-drawing cut the seat and disc. The valve leaked—pressure went up—the kiln temperature couldn't be controlled.

Preventive Maintenance counseled replacement with a two-inch pressure regulator. It would give ample steam for heating the kiln. It would give finer control without restricting operation of the automatic valve mechanism. A Crane No. 960 brass regulator was put in the line.

Results: No more interruption of kiln operation; no more shop time lost for lack of material. Another plant superintendent knows the value of Preventive Maintenance. Also knows the Crane Man can help him get most for piping maintenance dollars. Because Crane is not only the source of valves and fittings for every service, but of accurate information on their proper application as well.

This case is based on the personal experience of H. E. O., a Crane Representative in the St. Paul Branch.

REDUCED PRESSURES KEPT AT STEADY FLOW WITH CRANE 960's

Cutting down pressure is only part of the job of pressure reducing. What you also want is a steady flow in the service line. You get both in these sturdy-built Crane No. 960 Brass Pressure Regulators for steam or air.

The 960 is ideal for Preventive Maintenance on modern process lines—on vulcanizers, cookers, driers, paper machines, air tools, air blasts, in heating systems.

Unlike ordinary reducing valves, the Crane 960 maintains reduced pressure at the point desired regardless of how much steam or air is being used. It will not permit pressure build-up when service line is idle.

Crane 960's are available for reduced pressure ranges of 5 to 30 pounds and 31 to 200 pounds. Operation is simple; ready accessibility permits easy inspection and servicing. In 6 sizes up to 2". Page 415 of your Crane No. 52 Catalog gives complete specifications.

1940 and 85th YEAR

CRANE

CRANE CO., GENERAL OFFICES: 836 S. MICHIGAN AVE., CHICAGO

VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

FURFURAL REFINING OF LUBRICANTS

SOLVENT refining processes developed in the past few years are now applied generally in the manufacture of lubricating oils. Selective solvents remove constituents present in crude lubricating fractions which are considered undesirable from the standpoint of resistance to deterioration in service and which give undesirable viscosity-temperature characteristics to oils as finished by older refining methods.

Among the solvents used, furfural has received wide acceptance. Furfural refining was discovered by the Shell Oil Co. and developed commercially by The Texas Co. during 1931–1933. After operation of the first plant at the Indian Refining Co. refinery at Lawrenceville, Ill., The Texas Co.'s refinery at Port Arthur, Texas, installed a 5,000 bbl. per day (charge oil) unit in 1935.

The process involves the following steps:

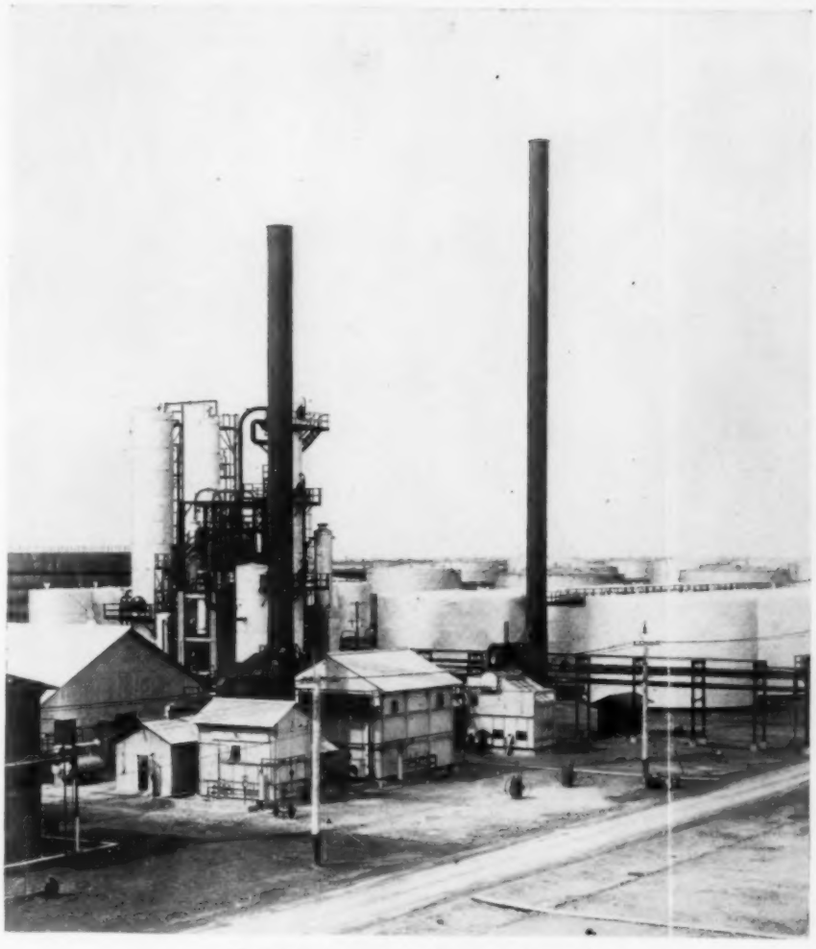
1. Continuous countercurrent extraction with furfural at controlled temperatures between 130 deg.–280 deg. F., depending on oil processed.
2. Recovery of solvent from refined oil and extract fractions by evaporation, using suitable heat exchange for fuel economy.
3. Steaming small amounts of the remaining solvent from extract and refined oil.
4. Recovery of furfural from furfural-water mixtures.

Flow rates on all streams are accurately controlled by suitable control instruments. Solvent losses average less than 0.05 per cent of the total solvent turnover. Furfural is rerun from ten to fifteen times daily. Total furfural refining capacity now amounts to over 30,000 bbl. charge stock per day.

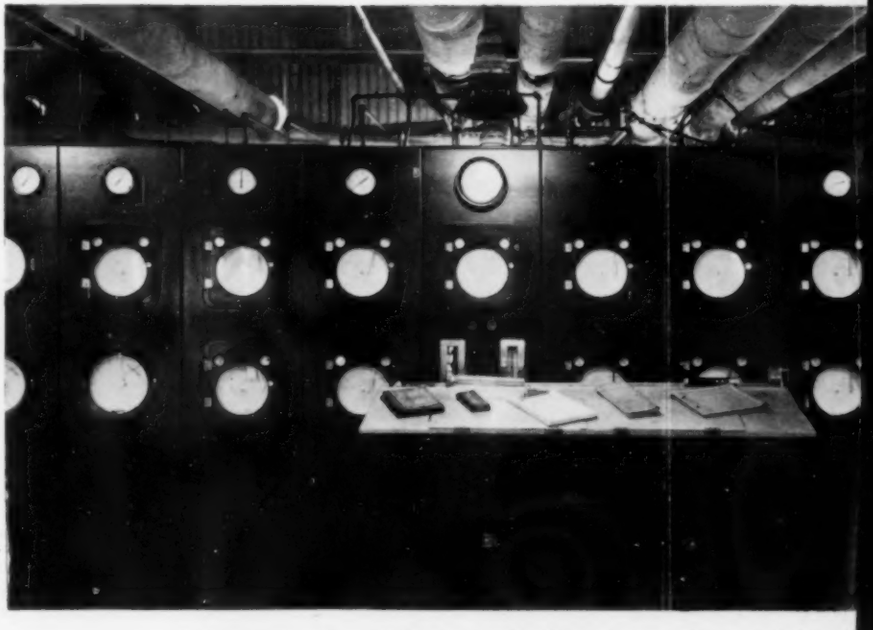
The accompanying flow diagram and illustrations cover a unit which processes both distillate and residual lubricating stocks from a variety of sources.

Refined oils are subjected to finishing treatment to meet color and other specified tests and to dewaxing to obtain low cold test.

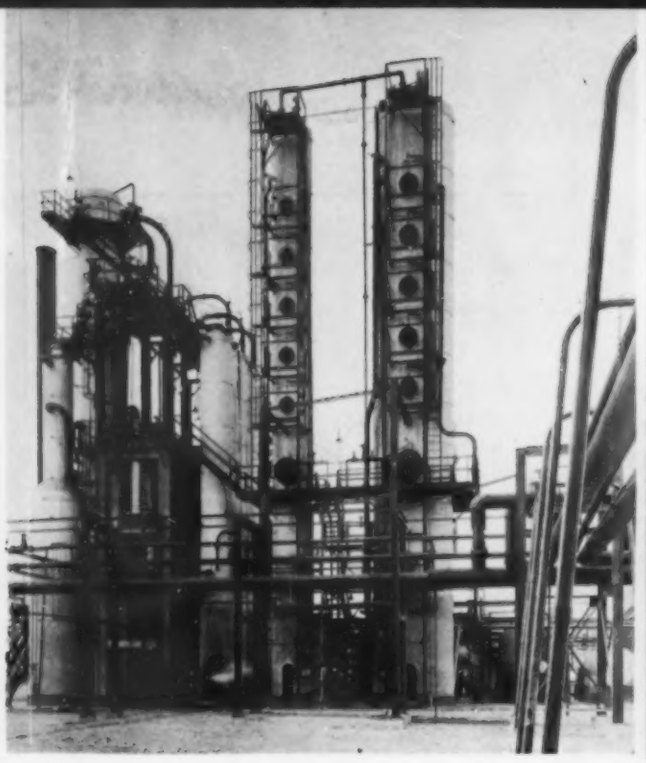
CHEMICAL & METALLURGICAL ENGINEERING
DECEMBER, 1940 • Pages 859–862



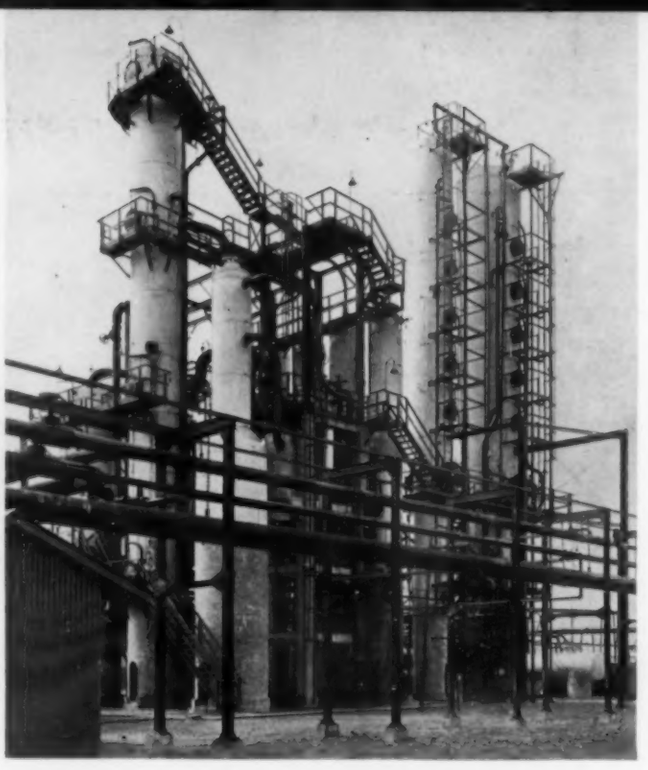
General view of furfural refin'ng unit with nominal charge oil capacity of 5,000 bbl. per day



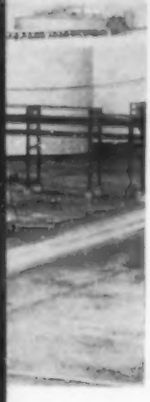
Instruments and control panel, showing rate of flow controllers
temperature and pressure indicators and recorders

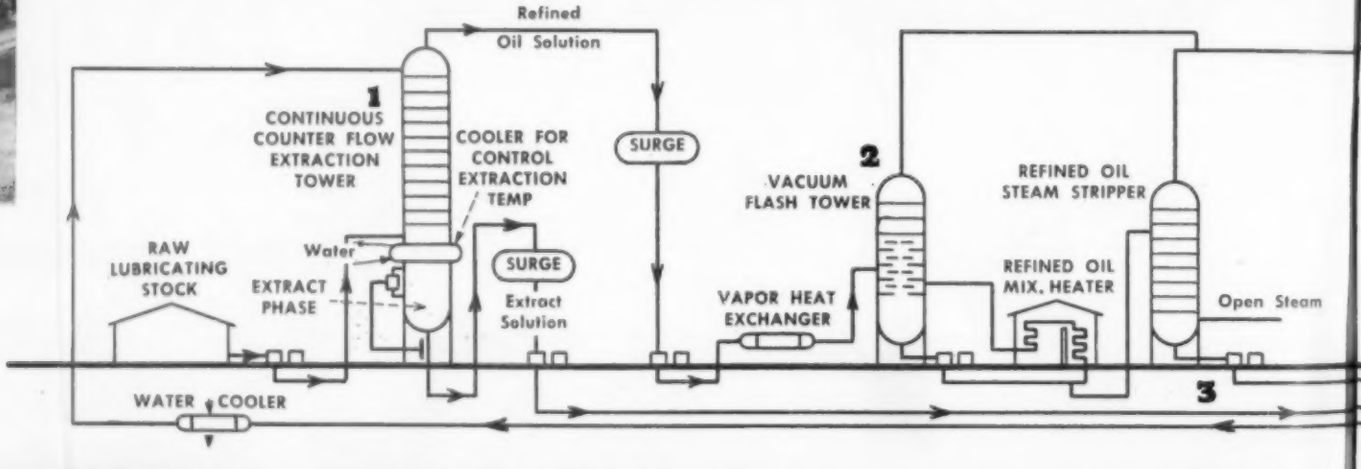


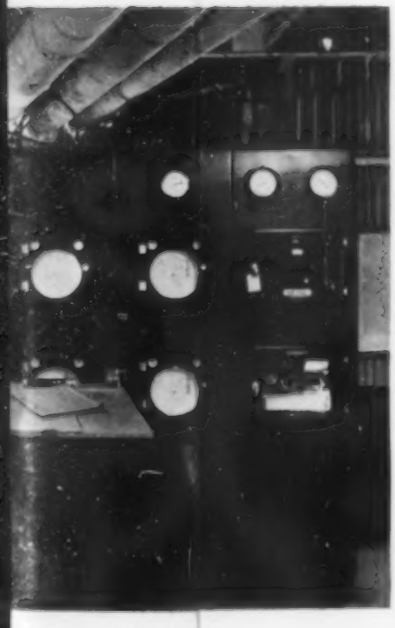
1 At right are two continuous counterflow furfural extraction towers. Equipment at left is part of solvent recovery system



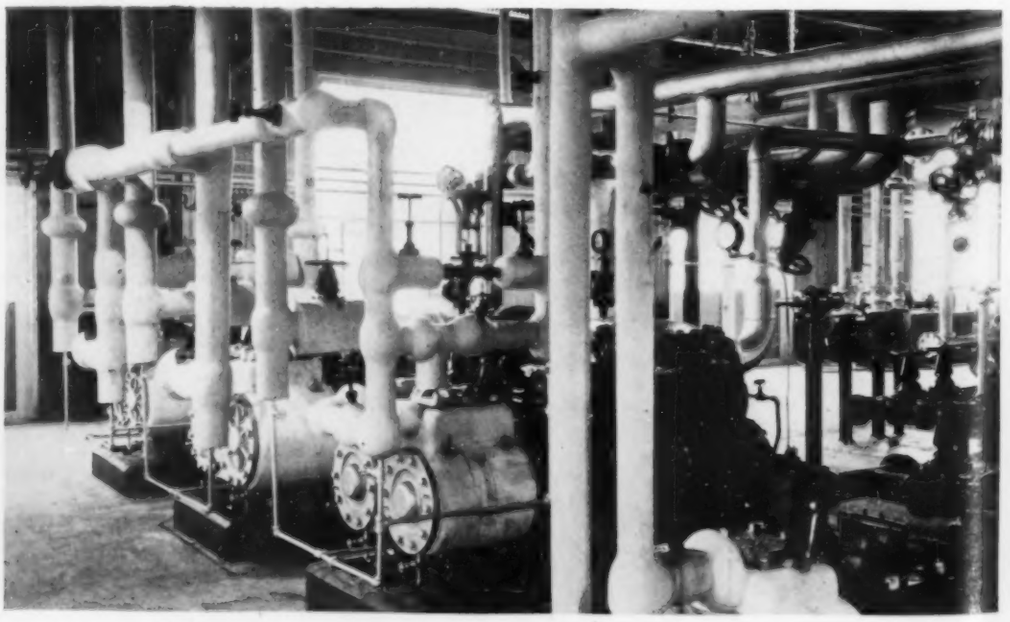
2 Refined oil vacuum flash tower appears at the extreme left in this view of the furfural installation for lubricating oils



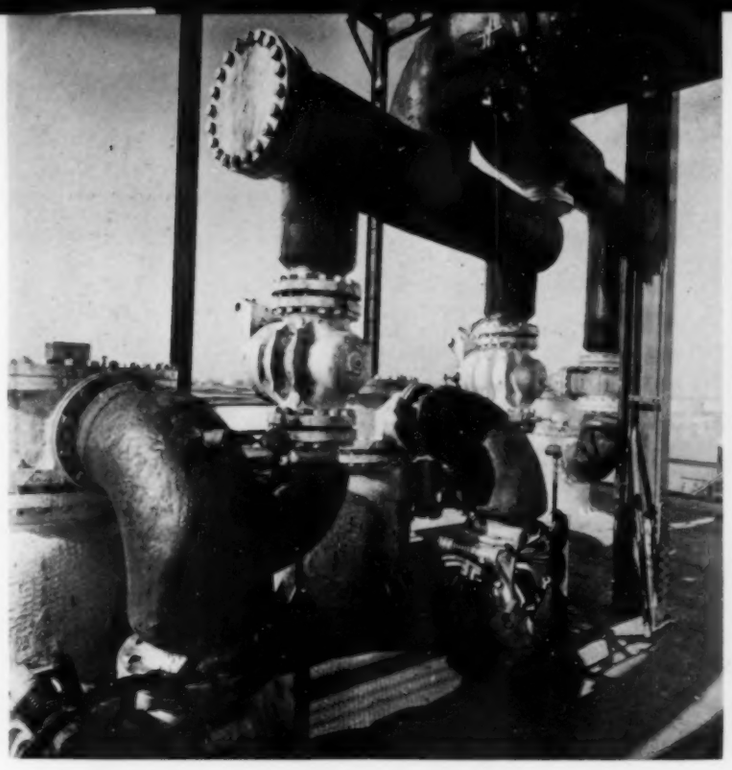




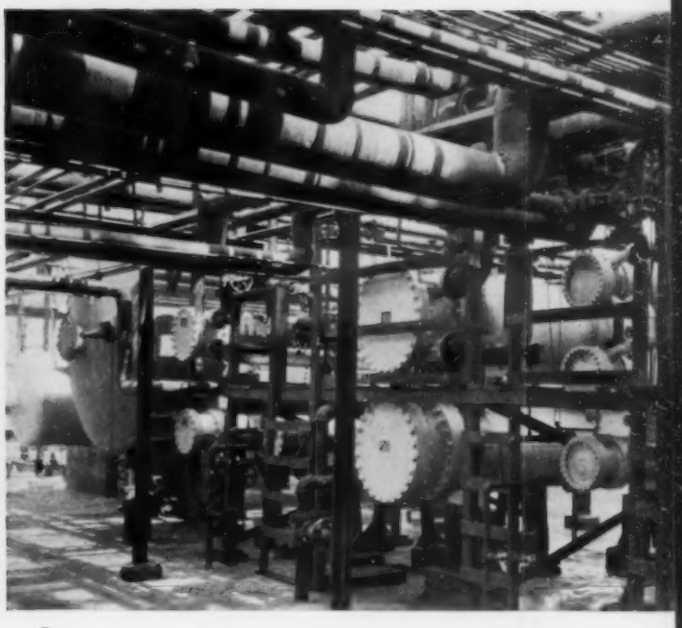
flow controllers and



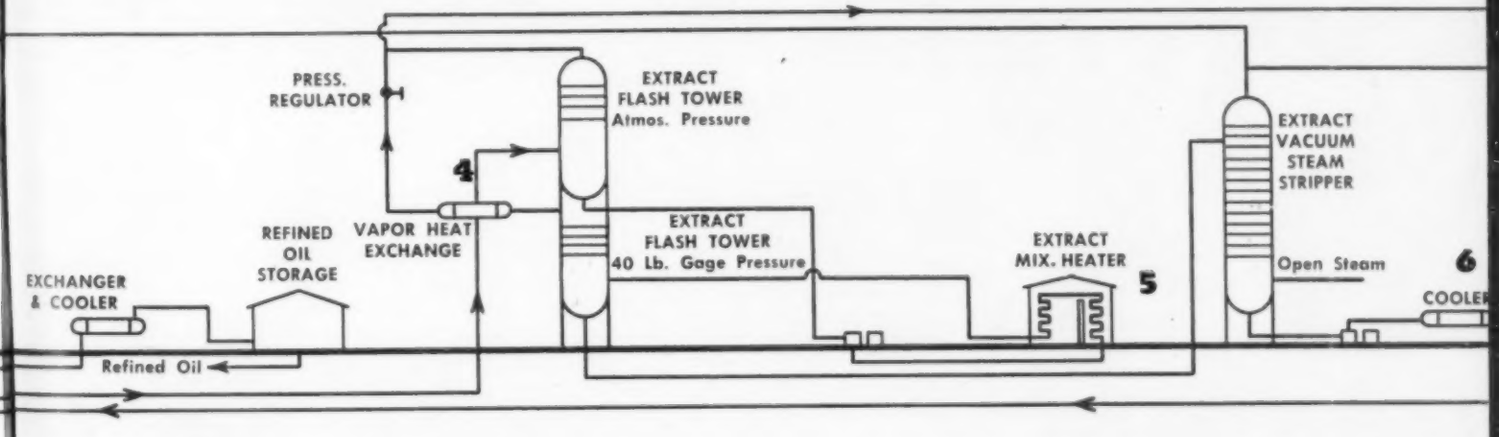
3 Interior of pump room of the furfural refining unit showing the extract solution transfer pumps

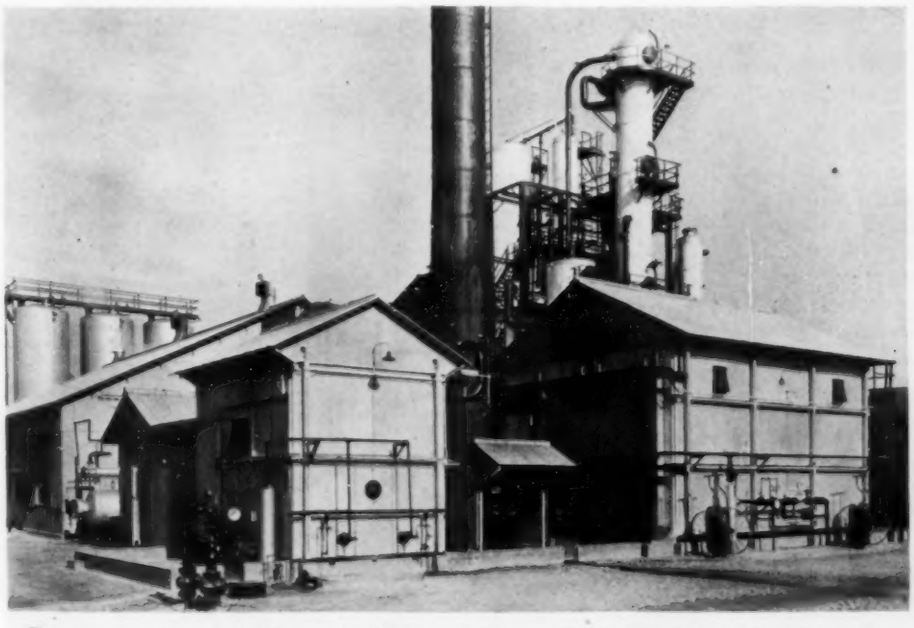


4 View showing three vapor and liquid heat exchangers in the furfural unit in the Texas Co.'s refinery at Port Arthur, Texas



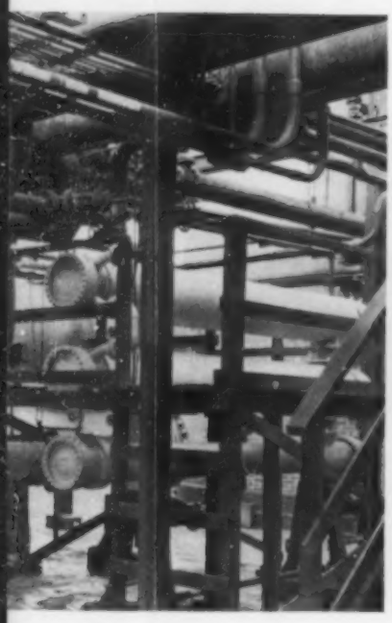
6 Battery of exchangers and coolers in the furfural unit at the T Port Arthur



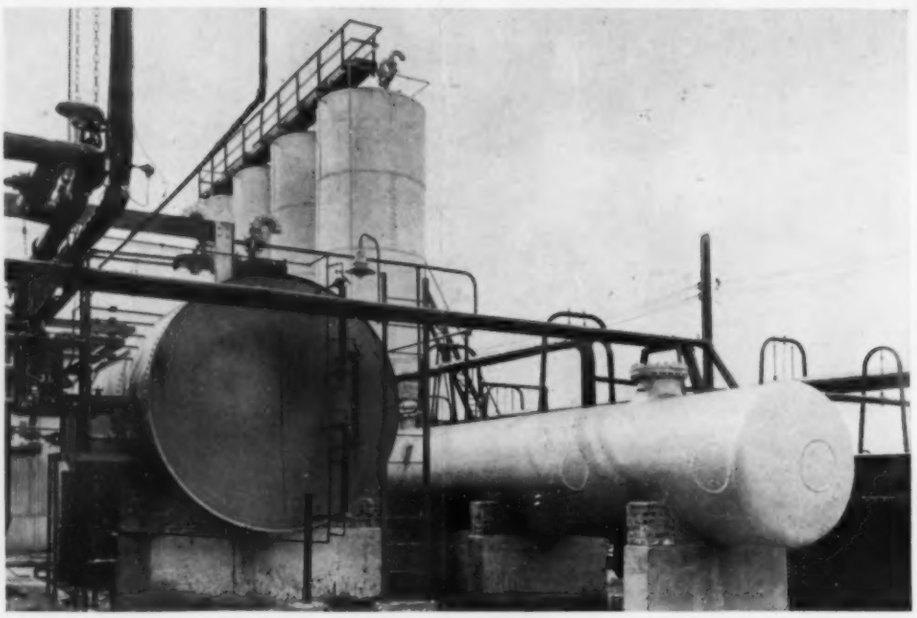


5 Left to right—in background—Solvent storage, pumphouse and control house. In foreground—Refined oil solution heater and extract solution heater

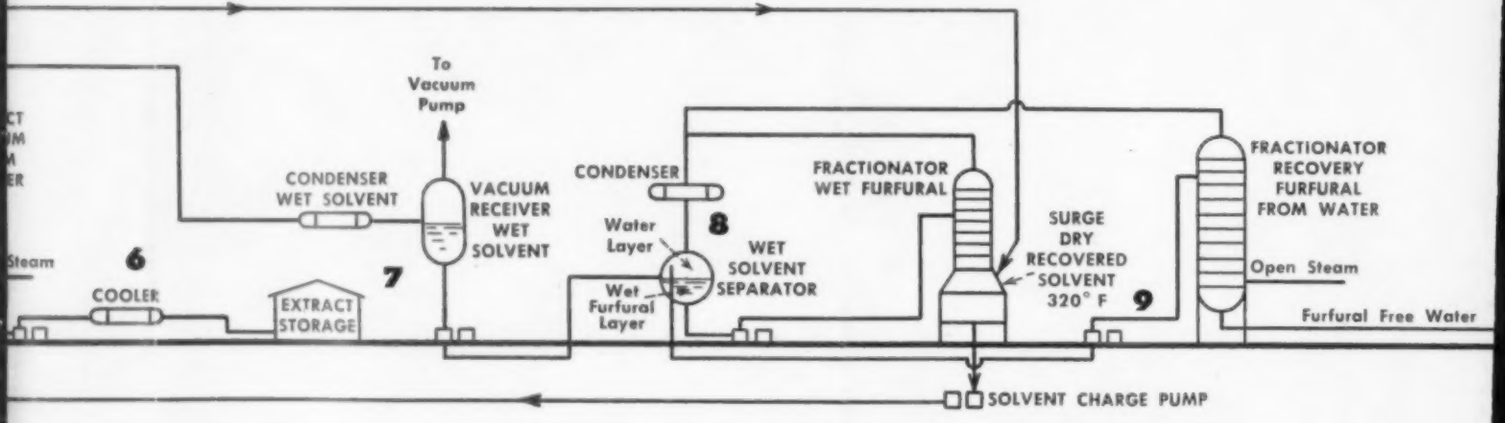
7 Charge oil and running tanks for the 5,000 background



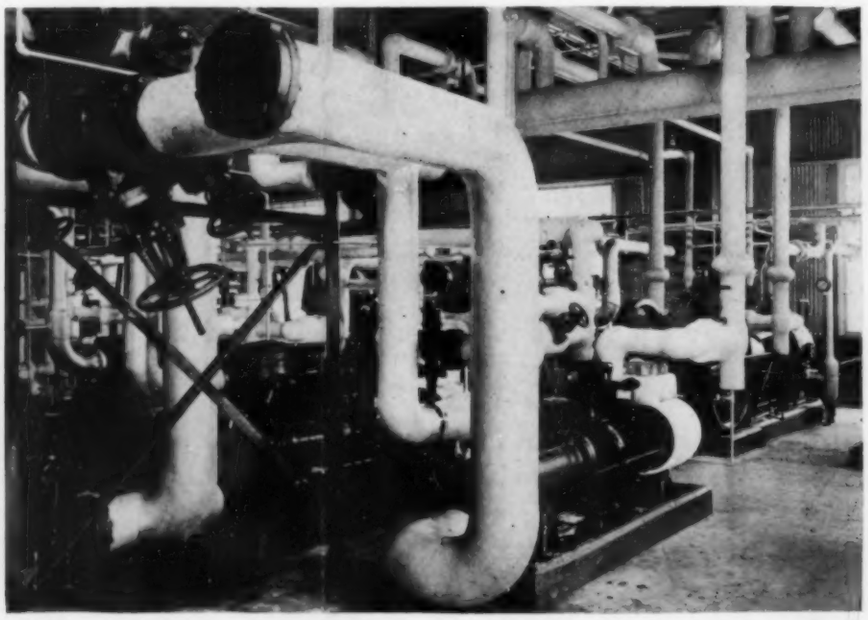
al unit at the Texas Co.'s refinery at



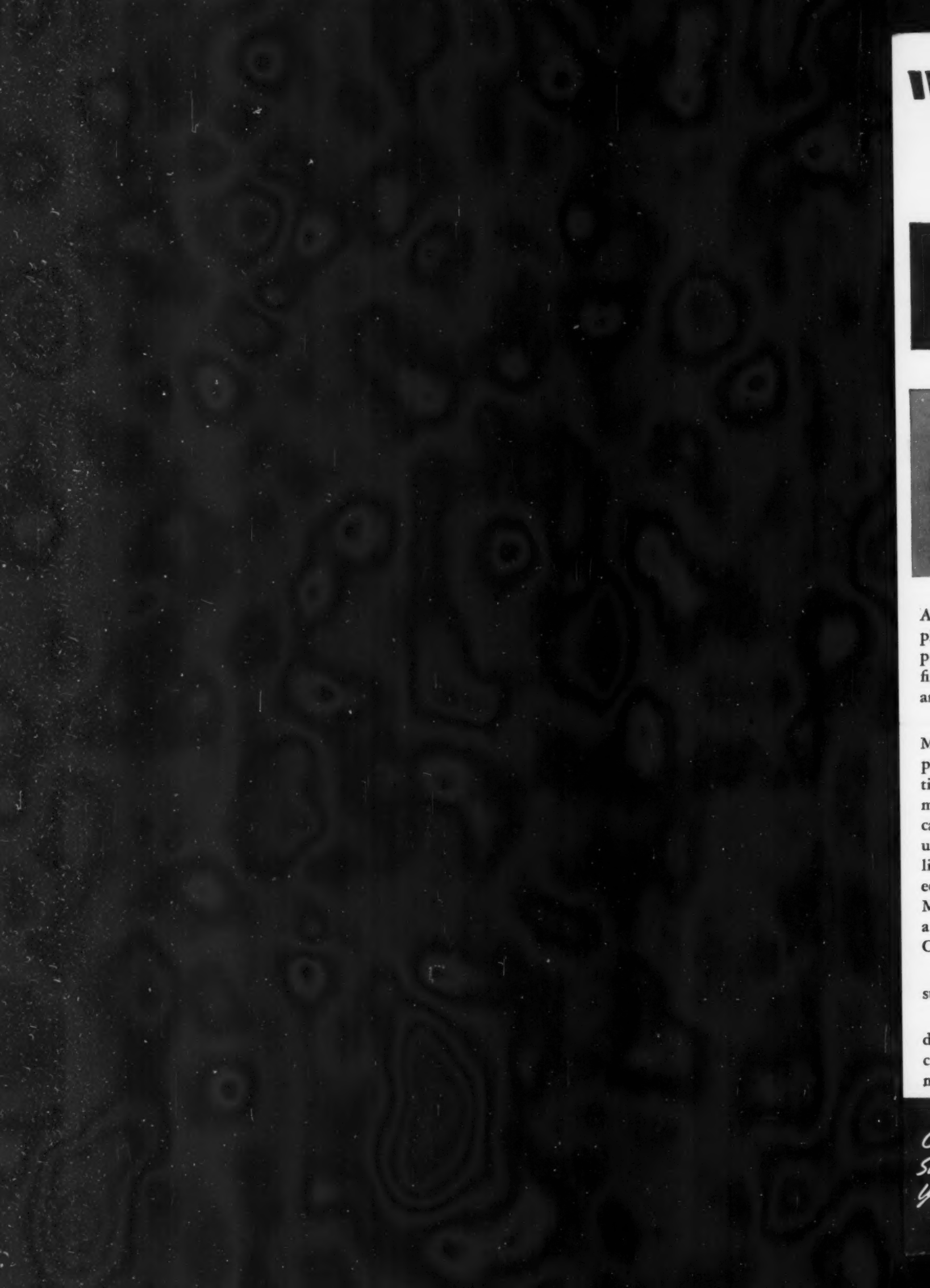
8 Large diameter horizontal tank is wet solvent separator in which water and furfural layers are separated and separately decanted to fractionators



s for the 5,000 bbl. furfural unit shown in the



9 Another view of the furfural pumphouse, extract mix pumps in the foreground, vacuum pumps in the background



"I'M TOUGH ON MOTORS!"

— Says E. H. Humberstone, Superintendent, Marble Cliff Quarries Co., Columbus, Ohio. And He Adds — "That's Why I Use Allis-Chalmers Lo-Maintenance Motors in Our Plants — 187 of Them!"

Another true case history from the Allis-Chalmers files that proves **"IT PAYS TO BUY THE EQUIPMENT THAT PAYS FOR ITSELF!"**

ONE OF 187 ALLIS-CHALMERS LO-Maintenance Motors in use in the Marble Cliff Quarries Co. plants, this 10-hp motor drives a double-deck screen . . . was installed in 1925. Service costs on this motor in fifteen years to date have been ***zero!***

A STONE process plant is a good place to get the low-down on motor performance. Abrasive stone dust fills the air . . . loads are heavy . . . and costs are closely watched!

That's how conditions are at the Marble Cliff Quarries Company plant, Columbus, Ohio . . . conditions that can wreck an ordinary motor in a few months. And because Marble Cliff Quarries want uninterrupted service... long motor life . . . low power costs . . . they've equipped their plants with 187 Lo-Maintenance Motors . . . practically a 100% representation for Allis-Chalmers!

But read what E. H. Humberstone, superintendent, has to say —

"We make flux for the steel industry, and that means we must keep close watch on our costs. Often our motors run 24 hours a day, for months at a time. Yes, I'm tough on motors — have to be! But for years we've given first choice to Lo-Maintenance Motors because we have found they give longer service with less servicing."

Your Best Buy is Lo-Maintenance!

What Mr. Humberstone says is being backed up by hundreds of other production men . . . men who want the low-cost, money-saving service Lo-Maintenance Motors give them . . . in reduced power costs . . . in longer life.

For in Allis-Chalmers Lo-Maintenance Motors you get performance that's more than just a rated horsepower. It's performance based on full-measure construction — indestructible rotor . . . distortionless stator . . . high carbon steel frame . . . no skimp or stint anywhere. These, plus all the other Lo-Maintenance features, make it the best motor buy for you.

For full information on how these motors can help you cut your power costs, see the trained engineer in the district office near you, or write Allis-Chalmers, Milwaukee. A 1294

Over 90 Years of Engineering Superiority Work for You When You Specify Allis-Chalmers!

ALLIS-CHALMERS

MILWAUKEE · WISCONSIN

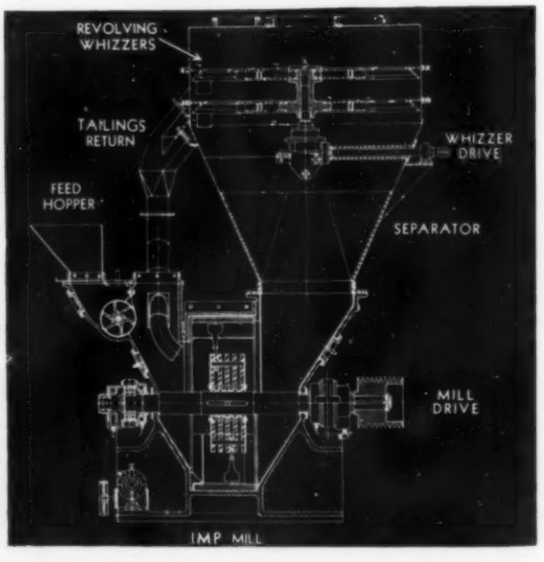
NEW Flexibility IN...

Fineness CONTROL

Think of turning a dial a few points and getting a range from 80% minus 100-mesh up to 99.5% through 325-mesh! That is the way you regulate the whizzer by a lever on the variable speed control, a feature that makes this versatile IMP MILL unique in its ability to meet exacting specifications in the production of powdered materials.

RAYMOND
Whizzer-Type IMP MILL

WHEN "rush orders" for powdered products put heavy pressure on your production department, you need a Pulverizer with quick, sure response to your every demand. Capable of instant adjustment to desired fineness while the machine is running . . . suitable for handling a wide variety of materials, wet or dry . . . adaptable for many different grinding operations . . . dependable on long runs of difficult pulverizing . . . economical on the basis of high capacity per horse-power. Today there is a machine doing all that and more . . . the Raymond IMP MILL equipped with single or double whizzer separator, and Flash Drying optional.



Would you like to know the amazing results obtained with the Raymond IMP MILL on chemicals, colors, plastics, clays and many special items? Then ask for Catalog No. 41.

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Chem & Met NEWS

SHELL OIL WILL BUILD SOLVENT EXTRACTION PLANT

Plans for the construction of a new-process solvent extraction plant, the first of its kind in the middle west, has been announced by R. C. Roberts, manager of the Shell Oil Co. refinery at Wood River, Ill. It will be the first plant ever to produce high solvency naphthas and odorless cleaning solvents successfully from mid-continent crude oils. The new plant, to be located at Shell's Wood River refinery, will cost $550,000 and will go into operation early next summer. Its construction is being carried on entirely separate from the $10,000,000 refinery expansion program announced early this year and now in its final stages at Wood River.

Constantly increasing national defense demands and the kindred expansion of the building industry, one of the largest users of naphthas, are given by B. G. Symon, technical products manager for the Shell company, as the primary reasons behind the erection of the plant.

Other naphthas manufactured in the new unit will be of the "odorless" variety. It is also stated that an odorless fly spray base will be produced, so free of smell and taste that sprays made from it can be used freely without annoyance.

When completed, the new Wood River plant will be one of the largest and most complete in the United States.

MERCK & CO. WILL CONSTRUCT NEW CONTROL LABORATORIES

Merck & Co. Inc., has completed plans for new analytical control laboratories to be built at the headquarters plant of the company at Rahway, N. J. The control division which will occupy the new building is responsible for testing all raw materials, ingredients, products, and packages for the company which turns out some 3,000 separate items in 13,000,000 containers per year.

Original features of the new laboratories are the result of extensive studies of operation and function. These studies were made by the laboratory staff in cooperation with the company's industrial engineers. Most striking feature is in the design of chemists' laboratory tables which are in the form of a cross. Each of the four angles is designed to provide a working area for one chemist whose writing desk will be within the individual angular area. Opposite ends of each cross will be assigned respectively to sinks and to compartments for clean glassware and balance areas for weighing samples. A fume "hood" will rise from the intersection and will provide individual access points for each chemist. High precision analytical balances will be located within a few feet of each working area. According to the new bench design, each chemist will work in a semi-private bay with all necessary facilities within or adjacent to his station. Traditional inconvenience, time loss, and "extra steps" will be practically eliminated.

DuPONT STARTS PRODUCTION OF POTASSIUM CYANIDE

Domestic manufacture of potassium cyanide, a "strategic" chemical employed in hardening tool steels, was announced on Dec. 4 by E. I. du Pont de Nemours & Company. This chemical until now has been imported, but little of the imported material is now available. Production of the material is under way in the company's R. & H. Chemicals Department.

Company spokesmen said the development was prompted by current U. S. needs, and the urgency of national self-sufficiency. American raw materials will be used exclusively. Potassium cyanide is important in heat-treating steel and in electroplating metals. It is also used in engraving and lithography. Du Pont is a large manufacturer of sodium cyanide, and pioneered in American manufacture of that related chemical.

CALCO OPENS NEW EFFLUENT TREATMENT PLANT

A new $500,000 effluent treatment plant was placed in operation at the Bound Brook plant by the Calco Chemical Division, American Cyanamid Co. last month. Governor A. Harry Moore, members of the State Department of Health and Sanitation, as well as various local and company officials were present at the opening.

The new plant is located nearly a mile westward from the main Calco plant. It is made up of, first, a compositing basin having a 5½-acre surface. The bulk of decolorizing takes place here. Adjacent to this first basin is another where ten million gallons of alkaline carbonate obtained from the nearby Johns-Manville Co. have been collected. Thirdly, there is mixing and controlling equipment which automotically regulates the addition of the carbonate slurry to the treated effluent to maintain a constant pH. The next unit in the process is a 60 million gallon capacity settling lagoon having a 23-acre surface, which gives a 5- to 6-day detention period. Lastly, is a diffusion, aeration and dilution dam stretching across the Raritán River.

Chem & Met Pictured Flow Sheet

JAPAN LOCATES LARGE DEPOSIT OF SULPHUR

A great setback for Japan's sulphuric acid industry was the disaster that wrecked the famous Matsuo sulphur mine. Sulphuric acid producers, or at least many of them, have been compelled to substitute pyrites for pure sulphur, with a corresponding loss in efficiency and net output, which in turn affected the production of ammonium sulphate, dyestuffs, and explosives.

At this juncture, great importance is being attached to the discovery of a new sulphur deposit. The new deposit was located at the Seishin River, in the Hokkaido, and is expected to yield 3,000,000 tons of sulphur, out of a probable content of 6,000,000 tons. Initial production is expected to amount to 3,000 to 4,000 tons a month. A steam refining plant will be installed at the suggestion of Dr. Yamada, of Kyoto Imperial University.

Another attempt at restoring sulphur production to former levels is being undertaken by the Imperial Mining Development Co., a semi-official holding corporation established some time ago to buy control in small unprofitable or inefficient mining enterprises.

CHEMICAL ENGINEERING APPROVAL GIVEN TO DETROIT

The University of Detroit has been notified by the Engineers Council for Professional Development that the curriculum in chemical engineering together with facilities for teaching the courses involved, including faculty, library and laboratory facilities has been accredited by this council.

This action by the Council followed accrediting of Chemical Engineering by the American Institute of Chemical Engineers which action was taken during the past summer as a result of an examination of the facilities in chemical engineering at the University.

Final accrediting of chemical engineering was the culmination of a six-year effort on the part of the University begun by Dr. H. E. Coles and carried on for the past four years by Dr. C. G. Duncombe under the administration of C. J. Freund, Dean of the College of Engineering.

News from Washington

WASHINGTON NEWS BUREAU, McGRAW-HILL PUBLISHING CO.

CONTRACTS for synthetic rubber manufacture did not materialize during November as expected. The delay in giving direct government aid to the enterprises which are to take up this manufacture at an accelerated rate has been very disappointing both to industry and to the technical planners. The matter has been held up in the offices of the R.F.C. where contracts had to be formulated in the name of Rubber Reserve Co., the quasi-government corporation now entrusted with synthetic development as well as purchase of natural rubber.

Still discussed, but apparently not too promising, is the novel proposal that this company buy all of the output of synthetic plants for at least a year. The quantity that would be purchased from any company during its development period would be determined, under this proposal, by the prices which the manufacturer would be willing to accept. Any maker of synthetic rubber which could produce an acceptable product at 20 or 25 cents per pound, could sell all that he would make. But those whose small-scale operations or early development costs would make necessary prices twice or more this rate, would not be expected to receive contracts for more than nominal tonnages.

All early synthetic rubber purchases, regardless of the plan used, are likely to be resold to rubber manufacturers for further development. The natural rubber purchased will presumably be held more or less indefinitely in the stockpile, for use only in the event of actual interruption of supply from the Far East. But at least a substantial part of the purchases of synthetic rubber, if and when they are made, will be resold promptly to the tire makers. The latter group will be expected to try out on a full commercial scale these new raw materials so that they surely can handle them efficiently when and if regular supply of such commodity becomes a part of the routine manufacturing raw material.

Apparently Rubber Reserve Co. has ample authority to carry out any such transactions, but the complicated form of contracts being discussed had prevented any definite conclusions even after two months of negotiation.

Explosive Licenses

Washington representatives of the chemical industry are much disturbed by the bill introduced in Congress by Representative Smith of West Virginia at the request of the Department of Interior (H.R. 10607). That bill proposes that everyone who makes explosives or buys or handles these materials (or a long list of ingredients used in making them) must get a license from the federal government. Any quantity greater than one ounce of many common industrial chemicals could be sold only to those having such license. And the first draft of the bill does not give the department authorities any privilege of shortening the list of commodities so regulated, though they do have proposed authority to increase the list whenever necessary.

The first plan is so complicated that every high school or college, every laboratory no matter how small, even the drug store, and in some cases grocery stores handling agricultural chemicals would require a federal license. The number of licensees would run up into the tens of thousands immediately; and an infinite amount of administrative supervision would be required.

Manufacturing Chemists' Association has had numerous conferences on this matter with department officials, the legislators interested, and representatives of the Federal Bureau of Investigation. They point out that the industry is just as anxious as the government to prevent diversion of dangerous chemicals or explosives to improper uses. But it appears that the multitude of details prescribed in the first draft, as made up by some very zealous attorneys, would do far more damage than good.

At the end of November it does not appear likely that Congress will give this bill any consideration before January. However, the desire to prevent the use of chemicals or explosives for sabotage purposes will probably result in a prompt consideration early next year.

Priority Rules

The contracting officers of Army and Navy have authority to assign certain priority ratings to any orders for goods or equipment purchased for military purposes. The materials required immediately for training-camp use get A-1 priority. Other types of military goods rate downward in the A series as far as A-9, the materials required on educational orders.

Such priority rating is merely a request to the manufacturer to meet certain indicated delivery dates. He is asked to give preference to such orders over other government or private deliveries where necessary to meet the required date. This is a request and not an order. But without exception the industry executives are cooperating and meeting the requests or arranging satisfactorily for readjustment of dates of delivery.

A comparable scheme of cooperation in allocation of products to the U. S. government, the British government, and perhaps the Canadian authorities, was being worked out at the end of November. Machine tools were the most important item given priority attention, but considerable thought was being applied to such commodities as steel and zinc. It is feared that some of these industrial raw materials may have to be rationed before many months are past. Certainly they will require such treatment if a shooting war begins.

There are no blanket ratings either now used or contemplated. No company gets a general priority classification nor is any particular industry singled out. Priorities are applied solely to specific orders for definite quantities of goods wanted at particular dates. And the Priorities Board hopes to maintain this rifle shot method of solving problems and avoid any scatter-bore shotgun technic.

Munitions Plants

The Army has claimed that the seeming slowness in getting contracts signed and ground broken for the remainder of the munitions program is partly due to difficulty in getting men of experienced administrative and executive ability to get the whole range of operations functioning. Nearly a dozen chemical and ammunition assembly works for which money is available were not under contract early in December. Total cost of these plants will exceed $150,000,000. There appears to have been a trend to speed up the program by doubling up on the same projects. This was shown last month by adding tetryl production to the TNT-DNT plant to be operated by du Pont at Wilmington, Ill. Construction and equipment cost of this project has been increased from $11,000,000 to $17,700,000, partly to accommodate tetryl production. Further expansion is likely.

Negotiations on the contract for the du Pont and Allied Chemical & Dye ammonia works—former at Morgantown, W. Va.; the latter in Kentucky—and for the Tennessee Valley Authority-operated ammonium nitrate works, which includes a 150-ton daily capacity synthetic ammonia plant, were completed during November. Formal announcement of the Morgantown unit to cost $15,000,000 was made Nov. 30 and was followed three days later by an announcement that $6,500,000 had been allocated to TVA to build a new ammonia plant and for reconditioning the Muscle Shoals nitrate works. Production capacity of the du Pont plant was not announced but it is to be considerably larger than the one at TVA. The Allied Chemical & Dye ammonia plant is to be roughly similar to that being built by du Pont.

Contract for the TNT-DNT plant at St. Charles, Mo., to be Atlas Powder operated, was completed during the month. Construction will cost $11,325,000 on initial plans, with prospects of expansion being ordered before the job is done. Other progress during the month on previously identified

for the Union Center, Ind., and Burlington (formerly listed as Davenport), Ia., ammunition loading assemblies. Todd & Brown, Inc., New York, will operate the Union Center project; Day & Zimmerman, Philadelphia, the Iowa assembly.

Aluminum Supply

Formal announcement came late in November from Defense Commissioner Stettinius, in charge of raw materials, that the country is now assured an adequate supply of aluminum to meet all defense and commercial requirements in sight—with margin to spare. (See Chem. & Met. for Nov. '40, p. 794). Arrangements to considerably more than double 1939 production facilities are credited with bringing this about.

The picture may not be as rosy as it sounds, however. Not all the production expansion which was lumped together to compile the 825,000,000-lb. a year capacity total for July, 1942, is actually certain to materialize. Plant facilities actually underway or planned, for which sufficient power supply is available, assure a production capacity of 780,000,000 lb. by July, 1942. The rest of the announced total supply hinges upon obtaining additional power—probably available, but not certain when this was written.

In addition, the 825,000,000-lb. announced total is sufficient to supply normal markets and airplane requirements for present American and British orders, including the new 12,000-plane British program. It does not include an additional American plane program expected to materialize early in the next Congressional session, which may, or may not, be geared to mesh with the new British schedule.

Sharp increases in Arkansas bauxite production also is being arranged to supply the basic ore for this expanded program. New mines also are being brought in in Dutch Guiana to build up American ore stocks.

Present announced schedule of new plant additions follows: January, 1941, Alcoa, 30,000,000 lb.; April, 1941, Badin, N. C., 14,000,000; April-June, 1941, Vancouver, Wash., 90,000,000 (three units); January, 1942, Alcoa, 60,000,000 (two units); July, 1942, Alcoa, 30,000,000; July, 1941, Reynolds Metal Co. plant at Sheffield, Ala., comes into production with initial capacity of 20,000,000 lb., expanding to 60,000,000 lb. by July, 1942.

Activated Carbon Plants

Negotiations for construction of two government owned-privately operated activated carbon works using a domestic raw material to end this country's dependence upon coconut shell imports for gas masks, were virtually completed during November. National Carbon Co. will build one plant at Fostoria, O., where it has been producing a sawdust block charcoal on a pilot plant basis for some time, and Barneby-Chaney Co. will construct the other at Zanesville.

The plants are expected to cost around $1,000,000 each, but no estimates are available translating this into production volume. Additional plants may be added to the schedule later if and when the need becomes more acute and funds are available which are not more needed elsewhere.

An improved process for activating the charcoal produced with domestic raw materials available in abundance is understood to provide an even better cannister filter than the old coconut char filter. Chemical Warfare Service has been using pilot plant amounts of this new product in experimental gas mask production for more than a year.

Construction of the Ohio charcoal units will bring into reality the technical development reported in these pages a year ago as heralding the removal, for all practical purposes, of charcoal from the nation's strategics list. This event also was forecast as long ago as last March by the Army-Navy Munitions Board when, in a reference work of general information on strategic materials, it reported: "It is believed that within the next year large-scale production of an entirely satisfactory non-coconut char for gas mask cannisters will be available and thus will eliminate this now strategic materials from the list."

News "Fines"

Superphosphate Defined—At its recent meeting A.O.A.C. adopted the following definition: "Superphosphate is a product obtained by mixing a rock phosphate with either sulphuric acid or phosphoric acid or with both acids." Thus the fertilizer industry gets rid of the old confusion of definition which made certain slags appear in the high-grade fertilizer class.

Low Interest Loans—If the commercial banks do not loan money at from 1.5 to 4 per cent then the R.F.C. will do so. The bankers do not like this idea of very low interest rates even on plants built or expanded for government contracts. But the "government guarantees to contractors" make these rates reasonable, according to Federal Loan Administrator Jesse Jones, whose word is final in such matters.

Congress Stays—In its decision to remain in session Congress did not plan much legislation. It merely wanted to persuade the country that it was not going off home for a vacation leaving unrestrained the opportunity for war-like gestures by administrative officials. Most legislation pending will die with the end of this session and require re-introduction in January. But bills well advanced in this Congress really have a running start toward enactment next year.

Sorghum Sugar—Washington takes rather seriously the claims of important new methods for obtaining crystallized sucrose out of sorghum syrup which have been announced through the daily papers. When such results can be developed to the point worth commercialization there will be a new lot of congressmen back of the idea of creating more domestic sugar industry. Since sorghum grows in semi-arid land this might create a very strong new domestic sugar bloc. But the realists, even those optimistic, know that such developments lie some years ahead, if they come at all.

New I.C.C. Rules—The completely revised "regulations for transportation of explosives and other dangerous articles" were scheduled to be available to industry during December. The I.C.C. hopes that this revision can take full effect in January. The revision is in form and presentation rather than in substance, however. Every chemical enterprise will need to study the new rules, and officials hope that they will find them much easier to apply than the old complicated form.

Buying From South America—Uncle Sam intends to buy copper and other commodities from South America so that there will be no shortages in the United States. This technique will be applied to prevent price rises here which might otherwise result in lifting prices to encourage uneconomic U. S. development. Some purchase of Chilean nitrate is planned also, largely to aid the Chilean government in balancing its budget. Loans are also being extended by R.F.C. for railway development to bring manganese out of Brazil and for port and air-base development in the Argentine and Uruguay. All this is a part of the Hemisphere program. Stabilization of Latin American economy is a first step toward further good neighbor and mutual defense ends.

The New Labor Board—Appointment of Harry A. Millis as chairman of the National Labor Relations Board virtually insures a new philosophy at that labor-trouble spot. Several of the more radical staff members resigned when it was known that the President was going to name Millis as a successor to Madden, offering convincing proof of the more judicial character of the proceedings to be expected in the future. Millis is one of the most experienced labor conciliation men of the country and brings a spirit of cooperation in labor settlements to his new post. However, neither Millis nor Leiserson have any sympathy for a breakdown in the 40-hour week program. However judicial they may be in labor disputes they will probably offer little if any encouragement for a longer work week.

Stock Pile Growth—Government stock piles of strategic metals and minerals have not grown as fast as expected. Private industry is taking most of the imports. So long as this mean a building up of reserves in private hands the government does not object. In fact, officials prefer so to conserve stock pile money where feasible.

GERMAN ECONOMIC DECREES POINT TO INDUSTRIAL REORGANIZATION IN CONQUERED AREAS

Special Correspondence

INDICATIONS of some of the forms intended in a German "new order" on the Continent can be seen in recent administrative and economic decrees and industrial reorganization plans in the conquered areas. Since Oct. 1 Bohemia-Moravia has been incorporated completely into German customs territory, and Reich excise and sales turnover taxes are applied there. In Luxembourg regular Reichsmark currency has been introduced, and all exchange restrictions on transactions between Luxembourg and Germany have been removed. Barter arrangements have been completed to facilitate trade between the Netherlands and Sweden, with Berlin as the clearing center. A direct clearing system between Prague and Oslo has been established between the Czech National Bank and the Norges Bank, but payments between Bohemia-Moravia and the Netherlands have to go through the German Clearing Office in Berlin.

A joint German-Belgian exporting company was founded Sept. 9 by two leading iron and steel exporters, Otto Wolff, Cologne, and the Belgian Societe Commerciale d'Ougree, S. A., Ougree. Capital stock is one million RM, headquarters are at Cologne with a branch in Brussels, the former managed by a German and the latter by a Belgian. The Wolff firm, long important in the Near and Far East, especially in China, supplies chiefly railway materials and operates on such orders in conjunction with leading steel producers as Friedrich Krupp. The Belgian firm has an annual capacity of 1,000,000 metric tons and employs 12,000 workmen.

Alsace and Lorraine have been formally reincorporated into the Reich, adding some important industries and resources, chiefly iron ore and potash, to the German economy. In these areas, war-destroyed waterways, the Rhine-Marne canal, the Rhine-Rhone canal, the East canal, and the Saar Coal canal have been dredged, repaired, bridges restored, and have been in operation again since the middle of September. A crew of 20,000 workers repaired damage to restore the Albert canal in Belgium in record time.

The German Potash Syndicate is considerably strengthened by the addition of Alsace production, which amounted to 3.4 million metric tons of crude salts in 1938. After unprofitable competition in the early 20's, German and French potash producers fixed their sales quota in 1926 at 70 per cent and 30 per cent, respectively, for sales in world markets. Whereas the elimination of competition may now be an advantage to German producers, the severance from overseas markets and the increasing independence of other countries developing their own potash deposits may counteract the advantage. The Alsatian deposits, estimated at 340 million metric tons K_2O contained in ore averaging about 19 per cent pure potash, have been mined for only 30 years. An additional byproduct of the Alsace potash industry is bromine, production of which increased from 362,000 kg. in 1931 to 784,000 kg. in 1937. Since Oct. 1, in connection with the aforementioned decrees for Bohemia-Moravia, the Reich Potash Law of 1933 has applied also in the Protectorate. This provides for compulsory syndicatization of all producers of potash salts, the sale of potash at fixed prices, and the setting of production quotas for local producers.

At Pechelbronn in Alsace, the oldest oil field in Europe, new tests have been made by German engineers, and petroleum operations in this area have recently been resumed. The first deliveries of Russian mineral oil over the reconstructed inland water way from Cherson on the Black Sea, by way of Kiev, the Dnieper and Bug Rivers, to Brest-Litovsk, Poland, have just been made in new tank barges. This canal is probably frozen over by now and should be blocked by ice until late in the spring, but in 1941 the new route is expected to be of considerable importance as a means of transporting supplies from Russia to Germany.

The first goods made from purely Soviet cotton are now to be seen on the market. This supply, plus war stocks which the occupied territories had accumulated, account partly for the recent increase in textile ration allowances in Germany. A new restriction has occurred in the Reich in the form of a recent order forbidding the use of pure oleic acid (red oil) for processing textiles.

In the field of natural fibers the production of flax, especially in Silesia in eastern Germany, has increased sharply during the past few years. In the adjoining Sudeten areas of former Czecho-Slovakia considerable flax is also raised, and its importance has recently been emphasized by the transfer of the Kaiser Wilhelm Institute for Bast Fibre Research to Maehrisch-Schoenberg in the Sudetenland.

In the former Polish Corridor area at Litzmannstadt a new synthetic fiber company, the Zellgarn A. G. was organized recently to undertake production of a new casein fiber to be marketed under the trade name "Thiozell."

Potato fiber with a high percentage of alpha cellulose is being recovered for the cellulose industry under a process developed by the Thueringsche Zellwolle A. G. at Schwarza in 1938. The main problems, of storage and of cleaning, are claimed to have been solved by the development of machinery for cleaning, mincing the plants, and pressing them into briquets. By this process it is hoped to obtain 150,000 metric tons of pulp from the 1940 potato crop.

The Reich paper industry is using a substitute, "lactoline," to replace glycerine in the manufacture of special coated and glossy papers and glazed pasteboard. The new product is a 60 per cent solution of refined sodium lactate. Glycerine is at a premium in Germany as a result of increased requirements and decreased supplies caused by the drop in imports of vegetable oil seeds used by the soap industry. Normally the bulk of the Reich's peacetime annual output of about 12,000 metric tons of glycerine is supplied as a byproduct of the soap industry. In contrast to the situation in the World War, the Reich chemical industry can now produce glycerine from alternative raw materials, such as from fermentation of sugar and from propylene abundantly available in coal gas.

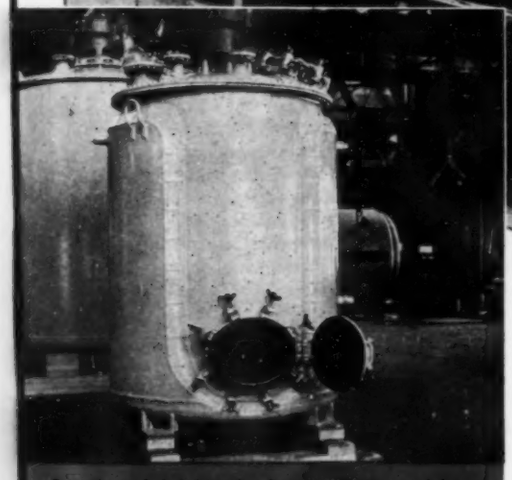
A new development in plastics is the announcement that a company has been organized to manufacture plastic container tubes on a large scale. For the past several years old toothpaste tubes and the like have been collected in various drives and have been regenerated to save metals. In 1938 a satisfactory process was developed for manufacturing synthetic container tubes in two pieces, consisting of multiple plastic layers with a cellophane base. They are provided with customary caps, which have been made of synthetic resin for some time. Large-scale production was held up until suitable manufacturing machinery could be developed. A newly formed concern with headquarters in Berlin announces that it will start production soon, turning out the tubes at the rate of one million monthly.

PITTSBURGH PLATE GLASS WILL SELL ITS OWN CHEMICALS

Sale of chemical products manufactured by the Pittsburgh Plate Glass Co., will be handled in the future by the company's Columbia Chemical Division, it was announced on Dec. 2. Previously, sale of such chemicals as soda ash, caustic soda, and chlorine, was conducted through The Columbia Alkali Corp., a wholly owned sales division.

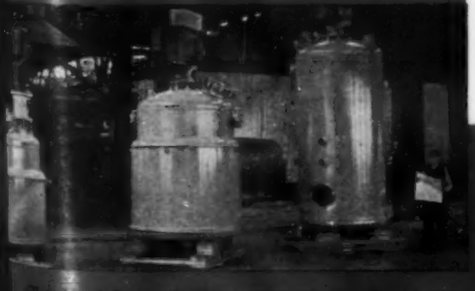
This action does not affect the personnel or sales organization. Customers will merely purchase direct from the Columbia Chemical Division of the company rather than through a wholly owned sales corporation as they have in the past. Eli Winkler, executive sales manager, and W. I. Galliher, director of sales, will retain their respective positions. The status of existing contracts of The Columbia Alkali Corporation and existing distributor relationships will not be affected by the change.

GREATER PRESSURES HIGHER TEMPERATURES LARGER SIZES

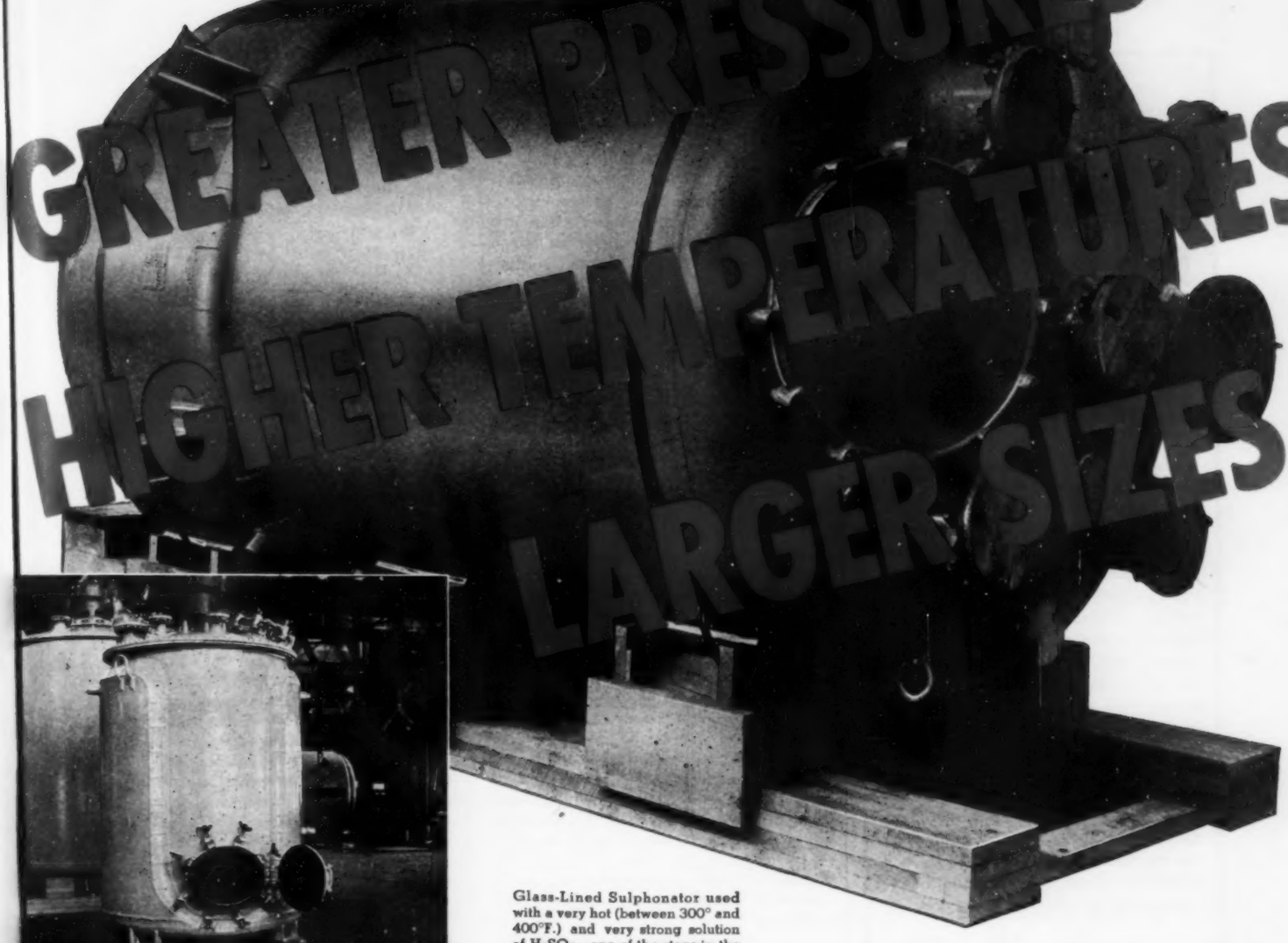


Partially jacketed Pfaudler Reaction Kettle used by a leading food company in the manufacture of a complex organic acid not previously manufactured in the U. S. Note large manhole door at bottom for easy clean-out.

Glass-Lined Polymerization Kettle equipped with electric heating coil giving a temperature of 600°F. during Polymerization of linseed oil to produce synthetic china wood oil.



Glass-lined Jacketed Chlorinator with Pfaudler glass-lined propeller agitator but powered by special stress-less pressure 50 lbs. per sq. in. Jacket pressure 75 lbs. per sq. in. Used for chlorinating natural rubber.



Glass-Lined Sulphonator used with a very hot (between 300° and 400°F.) and very strong solution of H_2SO_4—one of the steps in the manufacture of Carbolic Acid. Note eleven openings in tank head.

PFAUDLER GLASS IS THE ANSWER TO MORE OF YOUR PROCESSING PROBLEMS THAN EVER BEFORE

Shown on this page is concrete evidence of the progress of the continuous development program of Pfaudler Ceramic and Engineering Departments. These snap shots were all taken at our factories in recent months and are typical of the Glass-Lined corrosion-resisting equipment now being purchased by the chemical industries in the greatest quantities in our history.

Despite this condition, recent plant enlargements enable us to give you prompt delivery at no advance in prices. We cannot guarantee how long this condition will exist, so we suggest that you lay your corrosion-resistance problem before our engineering staff—promptly—that you may have the best possible service.

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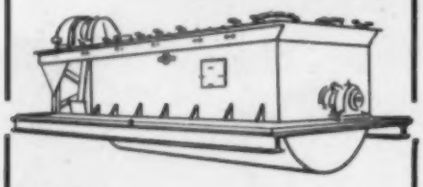
PFAUDLER

GLASS-LINED AND ALLOY EQUIPMENT



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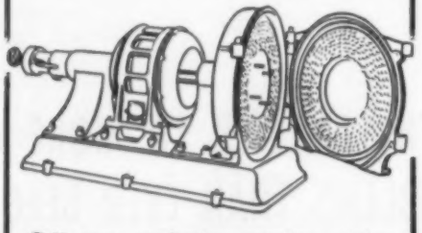
● For MIXING—the uniform particle distribution of two or more materials into a mass, without the individual particles losing their identity—we offer vertical, horizontal, continuous and conveying mixers in a wide variety of designs and sizes. For BLENDING—the co-mingling of particles so intimately that separate ingredients have lost their original identity—you should have a mixer with spatulating paddles, or a disc blender with inter-meshing cone projections for vigorous rubbing action. As designers and manufacturers of all these types of equipment, we are familiar with the abilities and limitations of each, and are qualified to recommend for any mixing requirement.



● If your production requires mixing or blending of chemicals, foodstuffs, soap, salts, cement, fertilizers, explosives, meat scraps, pulp or any other material, we think we can show you a way to do it better, faster, cheaper. Our recommendation involves no fee or obligation, of course. A letter puts it up to us. SPROUT, WALDRON & CO., INC., 143 Sherman St., Muncy, Pa.

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STATUS OF THE JAPANESE ARTIFICIAL PETROLEUM INDUSTRY

Development of the artificial petroleum industry in Japan and Manchoukuo is proceeding rapidly in spite of difficulties in obtaining building materials, according to the Journal of the Society of Chemical Industry, Japan. The Imperial Diet has set up two companies to license the manufacture of artificial petroleum and to subsidize such manufacturers. These companies are: Artificial Petroleum Production Enterprises and Imperial Liquid Fuel Industry Promoting Co., Ltd.

Present status of new plants in the industry, both in operation and under construction, is as follows (September, 1940):

High Pressure Hydrogenation—The first successful industrial scale pilot plant for the direct liquefaction of coal was put in operation by Chosen Coal Industries Co., Ltd., at its Agochi plant. A portion of the product already has been put on the market.

The Fushun plant of the South Manchurian Railway Co., Ltd., also a full-scale pilot plant, started operating almost at the same time, however. After 12 years of research, continuous operation of the liquid phase hydrogenation of coal paste was accomplished in the summer of 1939. In March of this year, the second stage hydrogenation of the product from the previous stage was also tested on plant scale.

In addition to these pilot plants, several larger hydrogenation units are now under construction or being designed.

One other company, the Manchurian Coal Liquefaction Research Institute, established last year, now has a pilot plant under construction at Mukden. It is being supervised by German experts and the equipment already has been imported from Krupp, Uhde and Borsig.

Fischer Process—Patents of the Fischer process were purchased through the Mitsui Trading Co. in 1936 and a full-sized pilot plant situated at Miike has been operating since June of this year. In this plant synthetic gas is prepared by the Koppers gasification process using Miike coal.

Three larger plants are now under construction at Hokkaido, Amagasaki and Chinchou.

Semi-industrial experiments on the synthetic process are being conducted at the Kyoto Imperial University and the Imperial Fuel Research Institute. The former has a new efficient catalyst composed chiefly of iron compound, and the latter has achieved the construction of a reaction chamber for operation at elevated pressure.

Low-Temperature Carbonization—The Eian plant of the Chosen Coal Industries Co., Ltd., was the pioneer plant of the low-temperature carbonization process, which produces low-temperature tar as the main product. Operation started in April 1932 with a Lurgi retort, but many improvements have since been applied to develop a new type.

Among several plants now working, three of them situated at Karafuto, Agochi and Takamatsu have adopted the Lurgi retort, one plant at Ube uses the Koppers vertical retort, and one Hokkaido plant uses the Shimomura process.

LOCATION OF BRITISH COLUMBIA COCONUT OIL PLANT IN DOUBT

Erection of a proposed $250,000 copra processing plant in British Columbia is now being used as both a political football and also as something in the nature of a competitive trophy on the Pacific Coast. The plant was originally to be erected in Vancouver and some preliminary work, estimated by local contractors to be worth $12,000 was done on the foundations for buildings. It was then discovered that the Vancouver fire bylaws prohibited erection of such a plant unless all storage tanks were below ground. The company then negotiated with the city of Westminster and secured permission to proceed with the project there.

Immediately following this announcement, Vancouver City Council had a full-dress debate and with a civic election in the immediate offing, the possibility of losing the plant was utilized to the fullest advantage by the various aldermen in discussions which savored slightly of pre-election politics. As the situation now stands it is still indefinite as to whether the new plant will be erected in Vancouver or New Westminster.

The plant will cost $250,000 wherever it is erected. The industry is backed by Sir Walter Carpenter of Sydney, Australia, one of the world's largest operators in the business. E. E. Buckerfield, managing director of Buckerfield's, Ltd., Vancouver, is one of the leading British Columbia directors.

PRODUCTS WITH NEWEST FINISHES TO BE DISPLAYED

An exhibit of products of every description finished with newest organic finishes by latest processes will be held at the offices of Maas & Waldstein Co., 438 Riverside Avenue, Newark, N. J. The exhibit will be open on week days, from Jan. 5 through Jan. 30.

Types of finishes to be exhibited include: clear lacquers, lacquer-enamels, air-drying and baking synthetic; also wrinkle enamels. They will be exhibited on many products, all of which have been finished under regular production conditions and will exemplify methods of obtaining various finishing results and of adapting finishing schedules to production programs.

Quick drying and baking finishes of great durability and protective quality will be featured. All types of finishes that can be effectively baked by the new infra-red radiant process will also be exhibited.

DU PONT ANNOUNCES RESEARCH FELLOWSHIPS FOR 1941-42

E. I. du Pont de Nemours & Co. has announced the award of six postdoctorate fellowships for research in organic chemistry, and twenty postgraduate fellowships for research in the field of chemistry for the academic year 1941-42. Twenty institutions will benefit. The postdoctorate fellowships are for $2,000 each, and the postgraduate fellowships are for $750 each.

The postdoctorate fellowships will be placed under the direction of R. T. Arnold, instructor, University of Minnesota; Paul Bartlett, assistant professor, Harvard University; Ralph Connor, assistant professor, University of Pennsylvania; R. C. Elderfield, assistant professor, Columbia University; C. B. Purves, assistant professor, Massachusetts Institute of Technology; and H. R. Snyder, instructor, University of Illinois. These men will succeed an equal number of faculty members who have held the grant in the past few years. This is in accord with the policy of rotating the grants so that especially meritorious younger instructors and professors may participate in the plan.

Appointments to the postgraduate fellowships will be made later in the academic year by the heads of the chemistry departments of the respective universities.

AUSTRALIA IS DEVELOPING CHEMICAL INDUSTRY

Under the stress of war-time conditions, Australia is making efforts to develop home resources to make up for the loss of materials formerly imported. Considerable attention has been given to growing plants which are important as bases for drugs and medicines. Progress is reported in attempts to produce morphine, strychnine, quinine, and ephedrine. In the chemical field considerable development also is reported. Potash to the value of $1,500,000 will be produced from alunite deposits at Lake Campion, West Australia. Deposits are estimated to be sufficient to meet needs of agriculture for 25 years at present rate of consumption. The immediate aim is to produce 200 tons weekly.

Imperial Chemical Industries is building a factory in Melbourne to cost $300,000 which is expected to begin production of food phosphates this month. A company in Sydney also plans to make phosphates. Imperial Chemical Industries has invested $2,500,000 in an alkali works at Adelaide and is producing soda ash and will add caustic soda, sodium chloride, bicarbonate of soda and other products. Production of gasoline from shale began in August at Glen Davis, South Wales, and is running 30,000 to 35,000 gal. daily with plans to triple this output. Power alcohol to the extent of 3,000,000 gal. a year is being produced from molasses.

Proved the Value of Furfural as a Solvent-Penetrant

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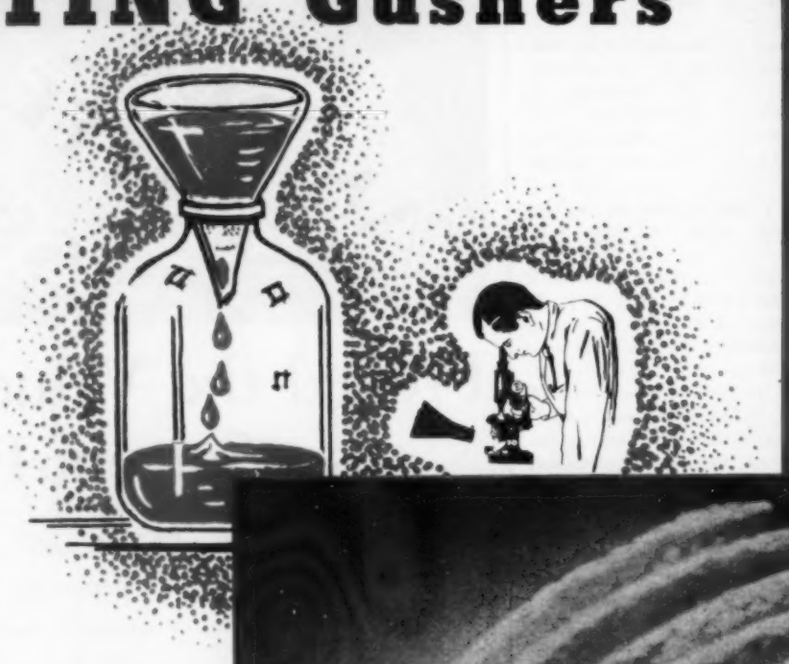
. . . from DRIPPING DROPS to SPOUTING Gushers



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PERSONALITIES

James B. Gaskins

P. H. Groggins

✦ JAMES B. GASKINS became associated with the Columbia Alkali Corp. on November 18 as a member of the technical service department. Since his graduation from William and Mary College in 1928, Mr. Gaskins has been associated with Meigs, Basset and Slaughter, Central Scientific Co., J. T. Baker Chemical Co. and Commercial Solvents Corp.

✦ JOHN M. SPANGLER, general sales manager of National Carbon Co., has been made a vice president of the company, Paul P. Huffard, the president, announced recently.

✦ RALPH T. GOODWIN has been appointed manager of fuel oil sales for Shell Oil Co., Inc. Dr. Goodwin's appointment has been made as part of a current decentralization move combining the eastern and midwestern producing and marketing units of the Shell company. He will be in complete charge of tractor, diesel, domestic, industrial and bunker fuels, kerosene and petroleum coke sales everywhere east of the Rockies.

✦ JOHN R. SUMAN, vice president, Humble Oil & Refining Co., Houston, Tex., has been elected president of the American Institute of Mining & Metallurgical Engineers. The two newly elected vice presidents are: Paul D. Merica, vice president, International Nickel Co., and LeRoy Salsich, president, Oliver Iron Mining Co. The new directors are: Clyde E. Williams, director, Battelle Memorial Institute, J. R. Van Pelt, Jr., assistant director, Museum of Science and Industry, I. B. Joralemon, president, Desert Silver, Inc., J. T. Duce, vice president, California Arabian Standard Oil Co.

✦ CHARLES E. HUNTER is now associate geologist for the Minerals Research Division of T.V.A. at Knoxville, Tenn.

✦ P. H. Groggins is now located at Philadelphia where he is a member of the staff of the Northern Regional Laboratory of the U. S. Department of Agriculture.

✦ JACKSON H. BEYER has joined the technical staff of Battelle Memorial Institute, Columbus, Ohio. He will be associated with the non-ferrous metallurgy division of the Institute. Mr. Beyer is a graduate of the University of Wisconsin in metallurgical engineering.

✦ W. D. COOLIDGE and STUART M. CROCKER have been appointed vice presidents of General Electric Co. Dr. Coolidge will continue as director of the research laboratory in Schenectady. Mr. Crocker will relinquish his duties as manager of the company's air conditioning and commercial refrigeration department at Bloomfield, N. J., to make his headquarters in New York, where he will cooperate with and be assisted by all commercial departfents in furthering the company's interests.

✦ GORDON H. CHAMBERS, vice president of the Foote Mineral Co., has recently returned from an extended vacation in South America. Mr. Chambers visited Peru, Bolivia, Argentine, Brazil, Porto Rico and Haiti.

✦ FRANK WALDO on November 6 became associated with the Columbia Alkali Corp., as a member of the technical service department in the capacity of market research specialist. Mr. Waldo has been active in the New York Paint, Oil & Varnish Club for several years and served on many of its committees. He was also active in the National Paint, Oil and Varnish Association, serving as its treasurer and a member of the executive committee.

✦ R. A. KARR has been appointed metallurgist for the Copperweld Steel Co. Mr. Karr was graduated from Lehigh in 1930. He was formerly employed at the Battelle Memorial Institute and later at the Central Alloy Division of the Republic Steel Co.

✦ T. M. HARRIS is now in the technical service department of the Pennsylvania Salt Mfg. Co., Philadelphia, Pa. He was previously located with Industrial Rayon Corp. at its Covington, Va., plant.

✦ ALAN R. LENNOX, is now on the staff of the Organic Chemicals Department, E. I. duPont de Nemours & Co., and is assigned to the Jackson Laboratory in Deepwater Point, N. J. He recently received his Master's degree from Purdue University.

✦ JOHNS R. HUBBARD is now associated with the Naval Research Laboratory, Navy Department, Washington, D. C. He is in the non-ferrous metallurgical department.

✦ G. B. PRITCHARD is on leave of absence from the Walworth Co. and on extended active duty at the Presidio of Monterey as adjutant of the Receiving Batallion, CASC unit 1930.

✦ FRANCIS WM. BROWN has become vice president of Resiston Plastics, Inc., Camden, N. J., manufacturers of synthetic resins. He will continue to act as consultant in the paint field and on the staff at Drexel Institute of Technology.

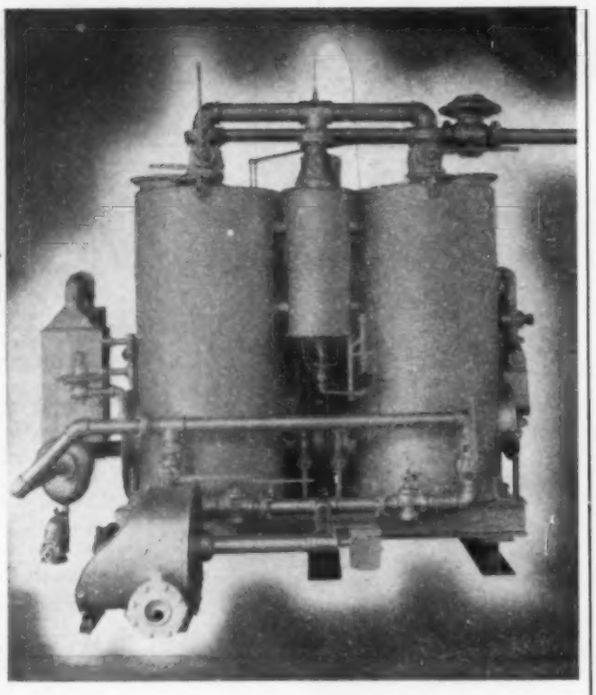
✦ A. W. HAWKINS is now an instructor in chemical engineering at Kansas State College, Manhattan, Kansas. He recently completed his work for his doctor's degree in the chemical engineering department of the University of Washington, Seattle.

✦ HENRY H. TIMKEN, JR., has been named chairman of the board of Timken Roller Bearing Co. He succeeds his father in this capacity and will continue as vice president and general manager of the Steel and Tube Division of the company. Mr. Timken has been associated with the company since his graduation from Harvard and has been a director for ten years.

✦ C. E. BALES, vice president of the Ironton Fire Brick Co., was elected president of the Ohio Ceramic Industries Association, at a meeting held at Ohio State University in November.

✦ M. O. SCHUR has been appointed director of Brown Co.'s newly organized

THINGS TO REMEMBER about *Silica Gel...*



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◆

THE DAVISON CHEMICAL CORP.

research and development department, according to an announcement made by Mr. H. P. Carruth, general manager of the company. Col. George A. Richter, who was formerly director of research, resigned from the company October 1 of this year.

✦ DAGMA L. FLOYD, formerly in the division of agricultural statistics A.M.S., Department of Agriculture, has been since the 1st of November, chief statistician for cotton and oils in the Bureau of Census, Department of Commerce. He succeeds Harvey J. Zimmerman who has retired.

R. K. Shirley

✦ R. K. SHIRLEY, who joined the organization of the Freeport Sulphur Co. in Texas in 1922, has been elected vice-president and treasurer of the company, Langbourne M. Williams, Jr., president recently announced.

A native Texan, Mr. Shirley started as chief clerk to the auditor and advanced successively to auditor, assistant general manager, assistant vice-president and comptroller, and treasurer.

•

✦ G. H. MCINTYRE of the Ferro Enamel Corp., has been appointed chairman of the committee of the Porcelain Enamel Institute on the research associate at the National Bureau of Standards. This committee supervises the work of Dr. Paul Smith, who has served as research associate for the Institute for the past three years. Dr. McIntyre's appointment as chairman of this committee was made at the fifth annual forum recently held at the University of Illinois. He is director of research for the Ferro Enamel Corp. at Cleveland, Ohio.

✦ W. C. BUCHANAN, president of Globe Steel Tubes Co., Milwaukee, was recently elected a member of the board of directors of Allis-Chalmers Mfg. Co. at the latter company's board meeting in New York.

✦ JOHN G. BRADEN is now employed by the Dayton Mfg. Co., Dayton, Ohio. He is engaged in research and production problems involving the use of

infra-red radiant energy for industrial heating. Mr. Braden received his degree in chemical engineering from Ohio State University in June of this year.

✦ W. F. BENDER, formerly associated with the U. S. Rubber Co., has been appointed chief engineer in charge of engineering and sales of the Sauereisen Cements Co., Pittsburgh.

✦ M. P. HOFMANN has been appointed manager of research and sales of the new colloid mill department of C. O. Bartlett & Snow Co., Cleveland.

✦ JOHN T. WARD, who has for a number of years been on the technical staff of M. W. Kellogg and Co., resigned from that position to take up executive work with the Boston Edison Co. His new work began during November.

OBITUARY

✦ W. J. AUSTIN died when an airplane in which he was a passenger crashed in Chicago December 4. Mr. Austin was president of the Austin Co., Cleveland, Ohio.

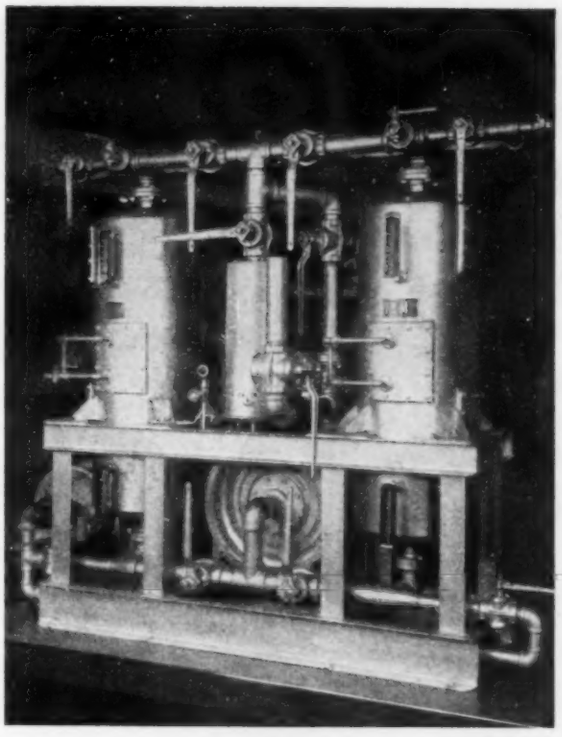
✦ FRANK B. HAMERLY of Aurora, Ill., vice-president of Independent Pneumatic Tool Co., of Chicago, died November 27 of a heart attack while inspecting the company's plant at Los Angeles. He was 53 years old.

✦ WILLIAM W. COBBS, research chemist for Monsanto Chemical Co., died from a fall which occurred during a hunting trip near Sullivan, Mo., November 21. Born in Montgomery, Ala., Mr. Cobbs lived in Anniston from 1925 to 1936, where he was employed by the local Monsanto plant. In 1937 he was assigned to the company's research laboratory at Dayton, Ohio, and at the time of his death was working on special duty at St. Louis.

✦ THOMAS CROWE, inventor and designer of metallurgical equipment and processes, died on November 16 at Palo Alto, Calif. Mr. Crowe had been a resident of Palo Alto for 17 years having been born in Emporia, Kans. He was graduated from the Colorado School of Mines in 1900 and for a number of years worked with the Portland Gold Mining Co. of Colorado, and also with the Merrill Co. in San Francisco.

✦ A. NAEGEL, editor of Forschung auf dem Gabiete des Ingenieurwesens of Berlin, Germany, died in September. He has been succeeded by Prof. Dr. Ing. Ernst Schmidt.

✦ CHARLES L. ALLEN, 82 years old and chairman of the board of Norton Co. and its general manager for 48 years until his retirement from that post in 1933, died November 4 at his home in Worcester, Mass. He had been sick a short time from bronchial pneumonia. Mr. Allen started with Norton Co. as a bookkeeper in 1881 when it was a pottery shop employing 13 men.



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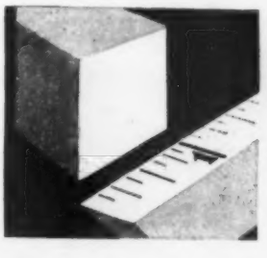

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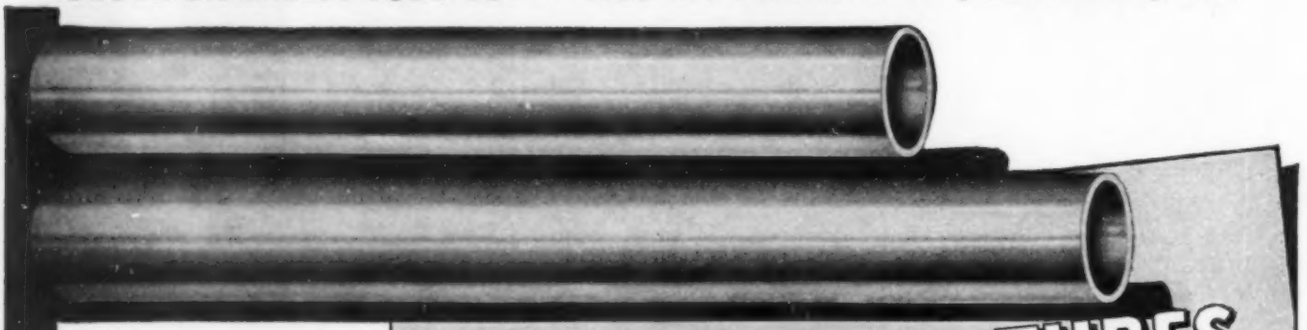

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Frary Elected President of A.I.Ch.E. at New Orleans Meeting

New officers of the American Institute of Chemical Engineers elected at the New Orleans meeting are, reading from left to right: F. C. Frary, president; S. D. Kirkpatrick, vice president; S. L. Tyler, secretary; C. R. DeLong, treasurer.

FRANCIS C. FRARY, director of research, Aluminum Co. of America, New Kensington, Pa., was elected president of the American Institute of Chemical Engineers at its 33rd annual meeting held at New Orleans, La., Dec. 2–4. Other officers elected to serve with Mr. Frary were: for vice-president, S. D. Kirkpatrick, editor of *Chemical & Metallurgical Engineering;* for secretary, Stephen L. Tyler; and for treasurer, C. R. DeLong, consulting chemical engineer of New York. The four new directors elected at this time were: James G. Vail, Philadelphia Quartz Co., Philadelphia, Pa.; R. L. Murray, Hooker Electrochemical Co., Niagara Falls, N. Y.; Norman W. Krase, Ammonia Department, E. I. Du Pont de Nemours & Co., Wilmington, Del.; A. E. Marshall, Rumford Chemical Works, Rumford, R. I.

All told, there were more than 400 chemical engineers, industrialists, and representatives of chemical industry from all parts of the country congregated at the St. Charles Hotel for the meeting. Twenty technical papers were read at the four technical sessions held on Monday, Tuesday and Wednesday. In addition, the chemical men made plant visits to a number of chemical process industry plants in and about New Orleans. Those in the immediate vicinity included the refinery of the Shell Petroleum Corporation at Norco, La., the Godchaux sugar house at Reserve, La., the American Sugar Refinery in New Orleans, the Louisiana Portland Cement plant, Southern Shell Fish Co. at Harvey, La.

On Thursday, Dec. 5, the Freeport Sulphur Co. at Grande Ecaille received a number of the Institute members, showing them the operation of their Frasch process for mining sulphur from the Louisiana marshes. A 2-day visit on Thursday and Friday was taken by a number of members to Hattiesburg and Laurel, Miss. to see the plant of the Hercules Powder Co. (naval stores), the Masonite Corp. and Sweet Potato Growers, Inc. (starch).

Abstracts of some of the papers presented at the meeting follow:

New Gypsum Plaster—Production of gypsum plaster by a new, wet process, has been worked out by E. P. Schoch and William A. Cunningham of the University of Texas. They have found that calcium sulphate hemi-hydrates produced by heating gypsum in various aqueous solutions have distinctive crystalline form and physical properties. Few of these make good plaster. Hemi-hydrate produced in magnesium sulphate solution, however, is an excellent plaster of Paris and has tensile and compressive strengths of approximately 600 and 4,600 lb. per sq.in. respectively. Furthermore, these strengths can be increased 50 per cent by moderate grinding.

The process has been tested by pilot plant operation, and economic studies indicate that the commercial production of a high-strength gypsum plaster by this method is entirely feasible. The process has the following advantages over the standard calcining procedure: (1) Product is harder and stronger, (2) cost of grinding both gypsum and plaster is eliminated or reduced to a minimum, (3) processing time is reduced to less than two hours. Disadvantages are the high initial cost of the equipment and high labor cost; however, these can be overcome, it is thought, by large installations.

There are four steps in the process: (1) cooking in an agitated jacketed kettle, (2) filtering in a centrifugal or Vallez filter, (3) drying in a steam-jacketed rotary dryer, and (4) evaporating in a forced-circulation vertical tube evaporator.

Deep South—Mr. Lee's paper on "Chemical Industries in the Deep South" is abstracted in considerable length on pp. 826-829 of this issue. Briefly, it describes the natural resources found along the Gulf Coast and the consequent migration of chemical industry to that area.

Free Private Enterprise—Mr. J. W. Irwin, assistant to the president, Monsanto Chemical Co., though not a technical man, discussed the chemical engineer's stake in free private enterprise from the vantage-point of an interested spectator.

Professional status, self direction of effort, and freedom from political influence, are the major elements of which this stake is composed, he said. All of these—and with them chemical engineering progress—would be seriously threatened in the event of collapse of the free enterprise system.

There will be no question about America's leadership in the scientific world after the current European war, according to Mr. Irwin. European nations under the stress of war are finding it necessary to put all of their efforts on applied science to the exclusion of fundamentals, and it is only upon a constantly developing founda-

CALENDAR

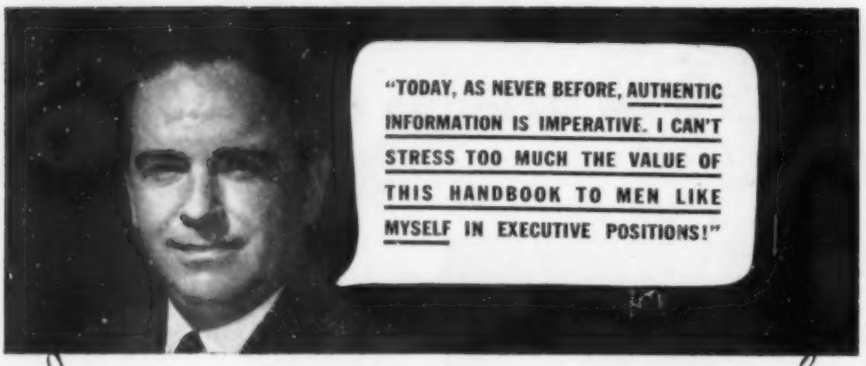
FEB. 17-20, 1941, **Technical Association of the Pulp and Paper Industry, annual meeting, Hotel Roosevelt, New York.**

APRIL 7-11, 1941, **American Chemical Society, St. Louis, Mo.**

APRIL 16-19, 1941, **Electrochemical Society, annual meeting, Cleveland, Ohio.**

MAY 19-21, 1941, **American Institute of Chemical Engineers, Chicago.**

MAY 19-23, 1941, **American Petroleum Institute, mid-year meeting, Fort Worth, Texas.**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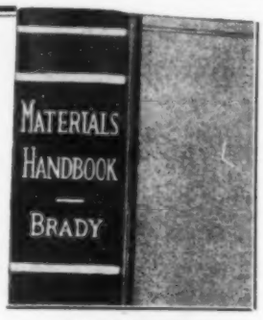

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tion of fundamental science that real and continuous progress in applied science can be achieved. America today offers greater opportunity for fundamental scientific research than any other country, Mr. Irwin stated.

Synthetic Glycerine—Shell Development Company's new process for the production of synthetic glycerine from petroleum as described by Dr. E. C. Williams is presented on pp. 834-838 of this issue. However, the paper as presented at the meeting contained additional information on glycerine derivatives. Apart from the glycerine itself, the commercial production of glycerine derivatives offers great promise through the availability of the reactive intermediates which are necessarily produced in the course of steps toward the glycerine synthesis, for example such intermediates as epichlorhydrin, mono and di glycerol chlorhydrins, glycidol, etc.

Also, a detailed economic picture of the glycerine market was presented which seemed to indicate that the time for synthetic glycerine was not yet, but the availability of a secondary source of supply might tend to stabilize glycerine prices.

Thermofor Kiln—New operating data on the Thermofor kiln are further demonstrating the economic advantage of this type of burning unit over the multiple hearth kiln and rotary burner for regenerating percolation clays used in petroleum refining, according to a paper by T. P. Simpson, E. S. Nicholls and J. W. Payne of the Socony-Vacuum Oil Co. Introduced to the petroleum industry a little over a year ago, the kiln is now being used on a commercial scale in four refineries. Savings of $11,000 to $23,000 per 100,000 bbl. of oil percolated are claimed.

Thermofor kilns provide close control of clay burning temperatures by means of a heat transfer system using a molten salt to absorb the heat of combustion, the authors stated.

The newest Thermofor kilns employ spiral finned heat transfer tubes, which permit advantages in construction, maintenance and operation of the units.

One commercial unit has now been in operation for almost two years with a 99 per cent service factor. Efficiency of clay burned in this unit after 18 months operation is still about 100 per cent. A 120-ton-per-day unit has been constructed for general refinery service and for activating clays to remarkably high efficiencies by carbonization.

Of the more recent Thermofor kiln installations, one 10-ton-per-day unit is being used with excellent results for burning bauxite employed in percolating waxes. A number of other possible applications in the chemical processing field have been suggested, such as regenerating bone char used in sugar refining, heat treating or burning ores, particularly in operations where it may be desirable to recover vapors—such as SO_2 from sulphide ores, roasting, heat treating or drying

of granular foods and distillation of oil from shale.

Distillation in Oil Refining—A broad field of application for distillation equipment is found in the oil refining industry, according to J. W. Packie, Standard Oil Development Co. In a typical complete modern refinery, the investment for distillation facilities, including distillation sections of other processing equipment represents approximately 64 per cent of the total investment for processing units, he stated. During 1939 the investment made for new processing equipment in oil refineries in the U. S. was approximately $110,000,000 of which about 45 per cent was for distillation units and distillation sections of other units.

Essentially, there are 12 distinct applications of distillation facilities in oil refineries which fall into two classifications:

1. Those involving the separation of a small number of pure components in which case theoretical methods are used for determining the operating temperatures and pressures and the fractionation.

2. Those involving the separation of wide boiling range products in which case empirical methods are used for the calculation on the fractionating system.

A comparison made between test results and the calculated results on a typical atmospheric crude distillation unit shows close agreement between the two.

Film Coefficient for Lower Alcohols—The effect of film temperature drop on film coefficient at the atmospheric boiling point for each of the eight monohydroxy alcohols below pentanol was studied by D. F. Othmer and R. E. White, of Polytechnic Institute of Brooklyn. They found that the data give straight lines in a logarithmic plot of the film coefficient versus film temperature drop. The lines for the normal alcohols substantiate the Nusselt equation, but there is an unexplainable divergence in the results for branched chain alcohols to give less of a reduction of coefficient with increasing temperature drop than would be expected from the equation.

Acetone Recovery—Acetone recovery from air by water washing has been studied in a semi-commercial scrubbing column, 19 ft. high by 10 in. inside diameter, operating in the range of concentrations of acetone in the air and in the washing solutions and of the gas and liquid velocities which are used in commercial units for this operation. D. F. Othmer and E. G. Scheibel of Polytechnic Institute of Brooklyn found that the following empirical equation held within the limits of experimental error:

$$K_{go} = \frac{1}{\frac{1060}{L^{1.8}} + \frac{15}{G^{0.8}}}$$

where K_g is overall coefficient (lb. mols./hr./sq.ft./atm.), a is area of surface per unit volume (sq.ft./cu.ft.), L is rate of liquid flow (lb./hr./sq.ft.

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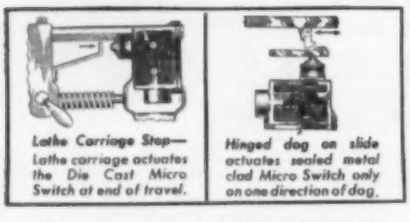

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of column cross section), and G is rate of gas flow (lb./hr./sq.ft. of column cross section). It is believed that this equation may safely be used for design purposes for gas rates up to several feet per second and liquid rates up to 1,000 lb. per hr. based on the cross section of the unpacked tower, for gas concentrations below 6 per cent by volume and for liquid strengths below 7 per cent acetone. As this equation indicates, the rate of absorption was found to be controlled by the resistance offered by both the liquid and the gas films. The pressure drop through the column under different conditions of gas and liquid flow was found to agree well with the data of others.

Phosphoric Acid—Studies of the collection of phosphoric acid mist in a pilot-plant tower and in a large-plant tower were described by W. H. Baskervill of the University of Tennessee. Towers were packed either with one inch Raschig rings or with coke. The effects of gas velocity (u, ft. per sec. on an empty tower basis) and of depth (h, ft.) of Raschig ring packing on the percentage recovery (R) in the pilot plant tower are expressed by the equation

$$R = 100 - 73e^{-0.0725h\,(U_{av})^2}$$

and the effect of pressure drop (ΔP, in. of water) is expressed by the equation

$$R = 100 - 73e^{-0.137\,\Delta P}$$

These equations apply to the production of 80 per cent H_3PO_4 when the gas entering the tower has an acid content of 2.0 to 2.5 lb. P_2O_5 per 1,000 cu.ft. The variation of recovery with the square of the velocity, or with the pressure drop, supports the belief that the packed-tower collection of the acid is essentially a process of mechanical separation.

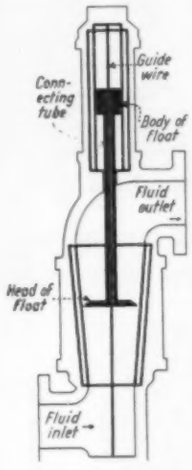
Practically all of the acid remaining in the gases from the large-plant tower was recovered in the form of dilute acid by condensing a portion of the water vapor in the gases. The dilute acid was returned to the top of the packed tower and concentrated. In each of the four operating tests, the phosphorus equivalent of the acid recovered in the large system was at least 99.9 per cent of the input to the phosphorus combustion chamber.

Solvent Extraction—A graphical method for the design of equipment for solvent extraction operations was presented by J. O. Maloney and A. E. Schubert of Pennsylvania State College. The method has as its basis a diagram expressing the usual equilibrium and saturation data in a manner exactly like that employed in the Ponchon and Savarit method for distillation. The calculations for the two types of separation processes, extraction and distillation, differ in no essential details.

Theory for the method has been developed by Randall and Longtin and already published. Therefore the purpose of this paper was to show how the method is applied to an actual problem and comparison of the results with the results by another method

(Varteressian and Fenske). The comparison showed very little difference. Advantages claimed by the authors are that the new method is simpler and that it can be carried out on ordinary rectangular coordinates instead of using triangular graph paper, as has been done heretofore.

New Rotameter—A new design of rotameter float has been developed which eliminates the effect of viscosity almost completely, according to Kermit Fischer, Seymour Bleckman and Eugene Lipstein of Fischer & Porter Co. The new float permits the use of rotameters for many flow metering services which could not previously be handled satisfactorily, they said. It also permits use of two or three rotameters in series as continuous pycnometers and continuous viscosimeters.



As shown in the accompanying sketch the new float (called Stabl-Vis) has its head and body separated by a hollow shaft. Thus the body which furnishes the desired weight to the float may be removed from the path of flow so that it will not add to the viscous drag of the float head.

Heat Transfer—Further results of an investigation of the performance of the long tube, vertical, natural-circulation evaporator were presented by J. R. Lientz of the Swenson Evaporator Co., and O. C. Cessna and W. L. Badger of the Dow Chemical Co.

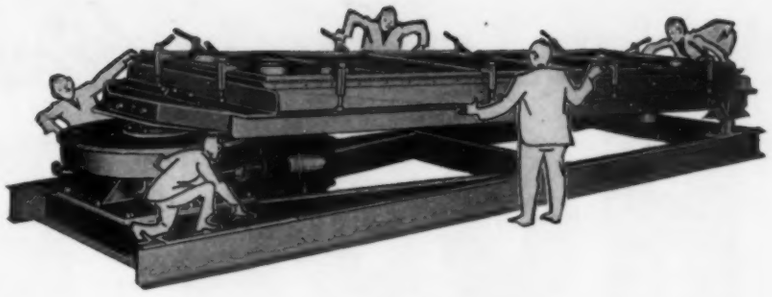
Heat transfer data obtained when feeding water and sucrose solutions to an evaporator having a single tube 1¼ in. o.d., 18½ ft. long were reported. Overall coefficients have been determined for the entire tube, and for the boiling and non-boiling sections over a range of operating conditions with the viscosity of the feed varying from 0.7 to 8.0 lb. per ft.-hr.

A correlation of the coefficients obtained from the non-boiling section was given and indicates that these coefficients follow an equation comparable in form to the Nusselt free-convection equation. The equation obtained is:

$$U_{NB} = 0.06\ (C\,\Delta\,T_{NB}\,\rho^2/\mu_{NB})^{0.7}$$

where U is overall coefficient, B.t.u. per (hr.) (sq.ft.) (deg. F.); C, specific heat of liquid, B.t.u. per (lb.) (deg. F.); $\Delta\ T$, temperature drop, deg. $F.$; ρ, density, lbs. per cu.ft.; μ, viscosity of liquid, lb. per (ft.) (hr.); and the NB refers to the non-boiling section.

No correlation was given for the coefficients obtained in the boiling section, but results differed from those obtained in other natural-circulation evaporators.



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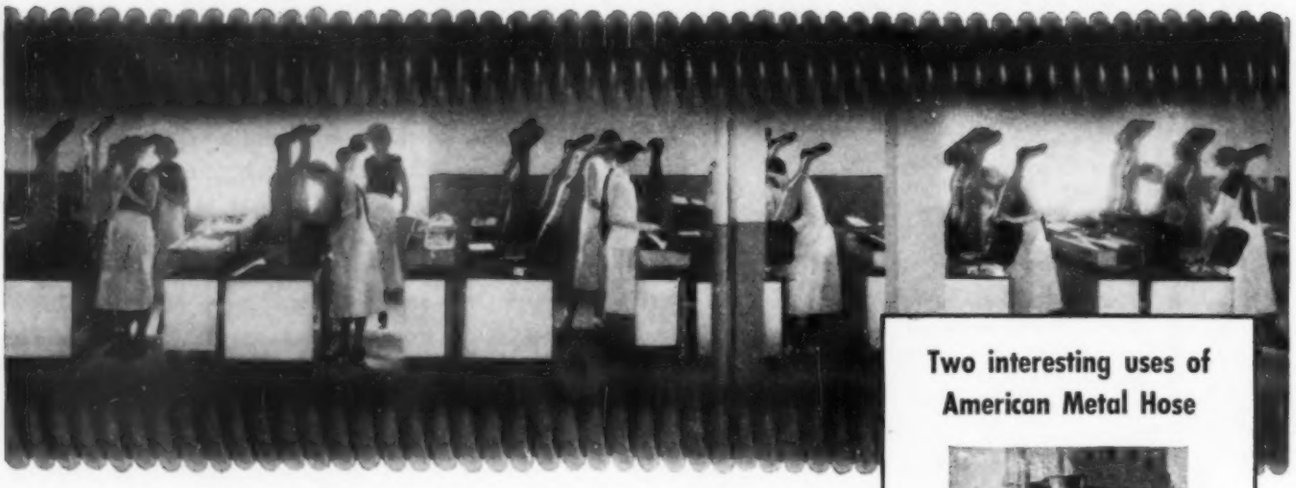

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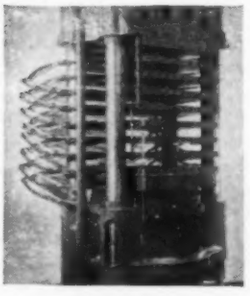

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Chicago Show Returns Emphasis To "Chemicals"

IN THE BOOTHS . . .

CHICAGO again became the country's chemical capital Dec. 11-15, when more than 20,000 people visited the National Chemical Exposition there and attended a series of conferences on chemical progress. In addition to the many commercial exhibits, Dr. C. Robert Moulton, formerly of the Museum of Science and Industry had charge of an educational and scientific display of chemical research work now under way in university laboratories and various research foundations. Added significance was given the show and conference because of the vital part that chemicals are destined to play in the program for national defense. Dr. R. C. Newton, chairman of the show committee, of the sponsoring section of the American Chemical Society, said:

> "This exposition is a veritable mobilization of the forces of chemical industry to throw the full weight of chemical progress into the gigantic task of building an adequate national defense."

All this combined to give more emphasis to the products rather than the equipment of chemical industry, although companies in the latter field were well represented. New machinery and new materials of construction, some of which have already been reported in the "Process Equipment News" sections of *Chem. & Met.*, will receive attention in our January and subsequent issues. The present report will therefore be confined to some of the more important new chemicals as exhibited in the booths or discussed in the various chemical conferences.

Nitroparaffines—An interesting group of organic chemicals, made commercially for the first time in 1940, were displayed in Commercial Solvents' booth. Nitromethane, nitroethane, 1-nitropropane and 2-nitropropane were the bases from which stemmed 12 nitroparaffine derivatives of which five are nitrohydroxy compounds, five are aminohydroxy compounds and two are salts of hydroxylamine.

The four nitroparaffines or NP's, as they are called, have already found many interesting applications in the industrial coating field as solvents for cellulose acetate, cellulose mixed esters, waxes and for vinyl and alkyd resins. Just as important as their solvent uses are the almost innumerable chemical reactions which the NP's will readily undergo, thus opening the way to a large and entirely new field of organic synthesis.

Among the nitroparaffine derivatives of immediate interest are the common higher fatty acid soaps of the amino-hydroxy compounds, which are proving to be excellent emulsifying agents for oils, fats and waxes and therefore find application in water-resistant floor waxes, non-yellowing cosmetic creams and ointments, etc.

Coal Tar Products—Recently developed processes for separation and purification of coal tar materials have led to several new series of products with interesting scientific and commercial possibilities. Reilly Tar & Chemical Corp. announced quantity production of the following new or newly refined chemicals: Meta-cresol, para-cresol, amino-pyridine, amino-picoline, beta-picoline, gamma picoline, 2,6-lutidine, quinoline, acridine, 2-methyl-naphthalene, 1-methyl-naphthalene, dimethyl naphthalene, diphenyl, fluorene, phenanthrene, chrysene, fluoranthene, acenaphthene, diphenyleneoxide.

A giant book, in the booth of the Koppers Co., whose pages turned automatically, carried information concerning their chemical contributions from coal. Among these chemicals, some of which only recently have been produced on a commercial basis are: ammonium thiocyanate; 3,5-xylenol; pyridine; alpha-methyl-naphthalene; flotation sulphur; 4-tert-butyl-*m*-cresol; alpha-picoline; beta-methyl-naphthalene; phenol; 4,6-di-tert-butyl-*m*-cresol; quinoline; acenaphthene; ortho-cresol; diphenylene oxide; carbazole; anthracene; meta-cresol; benzene, dicyclopentadiene; phenanthrene; para-cresol; toluene; naphthalene; and fluorene.

Glycols—Over 100 polyhydric alcohol esters were exhibited for the first time by Glyco Products Co., Inc. These comprise esters of glycerine, ethylene glycol, diethylene glycol, polymerized glycol, sorbitol, mannitol, Carbitol and Cellosolve. In addition to these new products, the company exhibited a synthetic emulsifying agent that forms stable emulsions of oils, solvents and waxes in the presence of mineral and organic salts, acids and other electrolytes which normally render emulsification difficult or impossible with the usual type of emulsifying agents.

Inorganics—New products exhibited for the first time by the Harshaw Chemical Co. included activated aluminum oxide, anhydrous muriatic acid, chromium oleate containing 5.8 per cent of chromium, copper hydroxide-naphthenated containing 50 per cent of copper, copper oxychloride-sulphate containing 55-57 per cent of copper, cupric oxide hydrated, nickel fluoborate and basic and neutral tin naphthenate.

W. A. Hammond Drierite Co. exhibited a section of telephone cable being dried in the splice with their inorganic drying agents now being used for laboratory and industrial purposes. It quickly absorbs 6.6 per cent of its weight of water from organic liquids and 8 to 14 per cent of its weight from most industrial gases.

Resins and Plastics—Saran, a newly developed thermoplastic vinylidene chloride resin of remarkable toughness and strength (up to 100,000 lb. per sq.in.), was shown by Dow Chemical Co. Other products included various plasticized forms of ethyl cellulose, transparent sheetings and similar coatings for protection and decoration. Methyl and ethyl ethers and cellulose, styrene resins, synthetic waxes were also shown by the same company.

Hercules Powder Co. displayed many new products of the resin family including cellulose acetate, ethyl cellulose, chlorinated rubber, pine oil, turpene solvents and rosin derivatives.

The hexahydric alcohols, mannitol and sorbitol, were exhibited by the Atlas Powder Co. along with many derivatives now finding application in the chemical and pharmaceutical industries.

Medicinal Chemicals—Merck & Co. cited the contributions of chemistry to national defense through the vital service to medicine and pharmacy. New chemotherapeutic agents included the sulfanilamide group and newer arsenicals. One of the most recent contributions that attracted attention was a display of the evolution of synthetic ephedrine and its production on a commercial scale. This synthetic product is now officially recognized by the United States Pharmacopeia and establishes an independent source of supply for this material whose properties are identical with those of the natural alkaloid.

IN THE CONFERENCES . . .

An attractive feature of the Chemical Exposition Week in Chicago was a series of industrial chemical conferences during which approximately a dozen interesting papers were presented to show the broad applications of chemical research and development in American industries. These conferences were held under the chairmanship of Bruce K. Brown, general manager of research and development, Standard Oil Co. (Ind.), William F. Henderson, chief chemist of the Visking Corporation, Professor C. D. Hurd of Northwestern University, President S. C. Lind of the American Chemical Society and Dr. Allen Abrams, technical director of the Marathon Paper Mills. Brief abstracts of some of these papers follow:

Petroleum Chemicals—Widespread interest in the petroleum industry as a new source of raw materials for the

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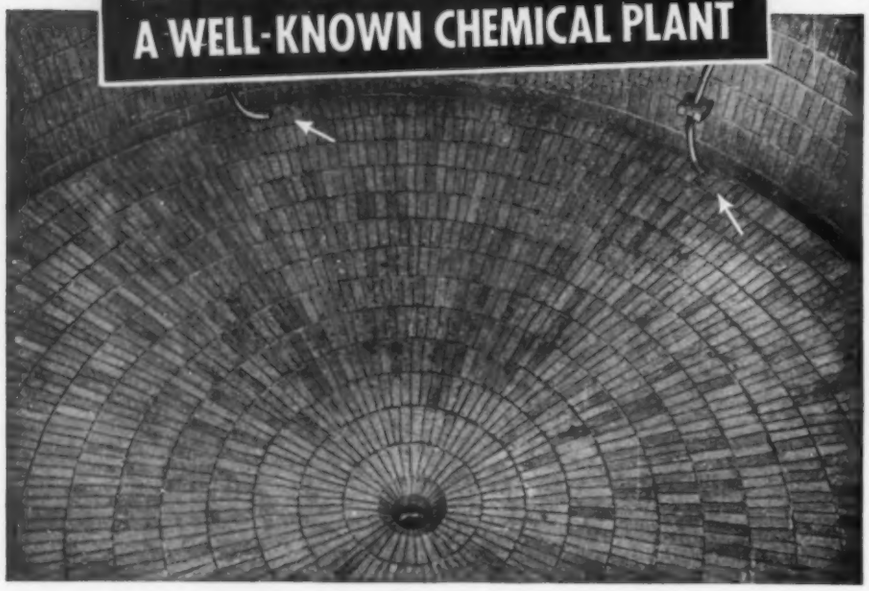

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Chemicals

manufacture of synthetic chemicals has tended to overshadow recent developments which are making this industry a significant consumer of synthetics, according to Walter G. Whitman, head of the department of chemical engineering at M.I.T. Many of the products which the oil refiner incorporates in fuels and lubricants come from outside the industry, but there is an increasing utilization of synthetic chemicals which themselves are produced in the refinery.

Synthetic chemicals are used in fuels and lubricants in two ways: as addition agents which are incorporated in relatively small percentages and as hydrocarbons which themselves constitute a large part or the whole of the fuel or lubricant. In general, the reason for using synthetic materials is to achieve higher standards of quality than would otherwise be attainable. The synthetics are expensive relative to the natural materials which are available and their use can seldom be justified save on a quality basis.

Synthetic Rubbers—A review was given by Per K. Frolich, director of chemical laboratories, Standard Oil Development Co., of the various available synthetic rubbers from the standpoint of their composition, the chemical raw materials and intermediates employed in their synthesis, and their properties and uses. In spite of the large number of synthetics which have been announced, it would appear that if ability to combine chemically (i.e. undergo vulcanization) with sulphur is taken as a criterion of a true rubber-like material, all these products represent only four basic types.

So far, the outlet for synthetic rubber in this country has been almost exclusively in the specialty field; that is, these products are being used where special advantage can be taken of the properties in which they excel natural rubber. This means that quality rather than price is a primary consideration. On this basis the synthetic rubber industry has developed to a point where plant capacity should be available early next year for the production of some 50,000 lb. per day.

A different situation would confront us should the threat of interference with regular shipments of crude rubber become imminent. Instead of being a specialty product, synthetic rubber would then have to supply our main demand for the natural product. A critical review of the situation leads to the conclusion that by judicious planning, the American chemical industry can in time meet any emergency which may presently be foreseen in this field.

Electrochemical Progress—A number of typical illustrations were cited by Colin G. Fink, head of the division of electrochemistry at Columbia University, emphasizing the far-reaching influence of electrolytic processes on the chemical industry of today. Metallic sodium, a curiosity in 1880, and

today consumed by the ton; ounces of magnesium metal for flash light powders in 1890 and thousands of tons of magnesium for airplanes today; gold and copper for the ruby glasses of 1920; and selenium-cadmium ruby glasses today; hot galvanizing and hot tinning of yesterday, electrogalvanizing and electrotinning today, are just a few of these illustrations.

As to the future, Dr. Fink found it difficult to predict without being fantastic. He foresaw electrolytic recoveries of many products now going to waste, the electrochemical extraction of gold and other valuable constituents in sea water and the isolation of new compounds unheard of today. Of special interest are the present indications and early prospects of far-reaching developments in the electro-organic field. The few instances that have recently attracted the industrialist will be multiplied many fold in the next years to come. By no other method or means than by the electrolytic is it possible to control and regulate reductions and oxidations of organic compounds to such a nicety. Organic reactions that, by older methods, require high temperatures or high pressures are readily carried through at ordinary temperatures and pressures when employing the electrolytic processes of today.

New Solvents—A review of the influence of new solvents on the future development of the chemical industry was given by C. L. Gabriel of the Commercial Solvents Corp. The year 1940, which ended a 20-year period in the development of new organic solvents, saw the installation of the first plant for the production of nitroparaffines from aliphatic hydrocarbons and nitric acid. These products are excellent solvents for cellulose acetate, cellulose nitrate, the Vinylites and many other resins. Whether the chief uses of these materials will eventually be as solvents or as raw materials for chemical synthesis is a little difficult to prophecy today. So far about one thousand derivatives of the nitroparaffines have been synthesized.

New needs for new solvents will undoubtedly arise as further technical developments are made. Although today it can be felt that the development of solvents has been a great influence in the development of chemical industries in this country, there is no reason to believe that a similar review given a decade or two hence will not show influences even more far reaching than those which have already occurred.

Friedel-Craft Reaction—In his paper on the Friedel and Craft reaction, E. C. Britton, director of organic research, The Dow Chemical Co., stated that for many years the Friedel-Craft reaction was regarded as a laboratory procedure, except in cases where a high priced chemical could be made in small lots. The commercial importance and possibilities were not unforseen by Friedel and Craft, however, for they patented in 1877 the splitting of ali-

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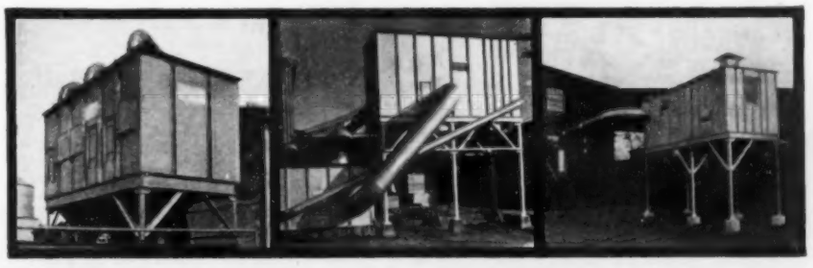

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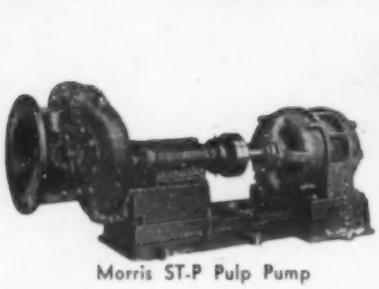

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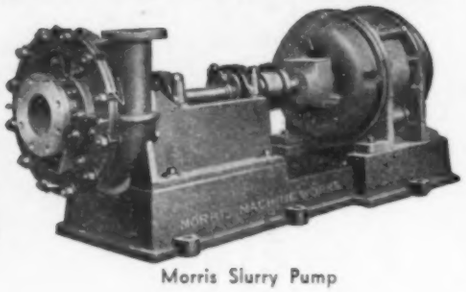

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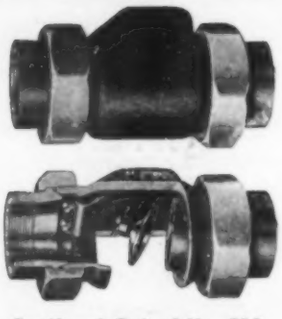

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phatic hydrocarbons by $AlCl_3$. The commercial use of the Friedel and Craft reaction was accelerated greatly by the domestic manufacture of anhydrous aluminum chloride which made available a cheap source of this product.

These reactions are of two types, namely, the catalytic type wherein the aluminum chloride is always available to act as a catalyst as in alkylation of benzene, and can be recovered and reused, and that type wherein the aluminum chloride reacts with the reaction product and loses its catalytic effect; hence a fresh supply of aluminum chloride must always be available for the reaction necessitating the use of at least one molar quantity per mole of product. In general, after a Fridel-Craft reaction of the second type, the reaction product is treated or is run into ice, some excess HCl is added to dissolve basic aluminum chloride and the organic compound is separated from the acidified water solution of aluminum chloride. When the reaction is truly catalytic, the catalyst may be separated directly from the organic product by distillation and in some reactions can be reused.

Service to Industry—The service of chemistry to industry was the subject of an address by Gustav Egloff, director of research, Universal Oil Products Co. Industry of today is leaning more and more upon service rendered by chemical research. No industry is too large or too small to be without an ever increasing amount of research. The fundamental studies carried out in our universities, chemical foundations, and industrial laboratories profoundly affect our manufacturing processes, our increased span of life, and our national defense.

Chemical research has provided the answer for many manufacturing, conservation and utilization problems since World War No. 1. Very often the index of progress and prosperity of a given industry lies not on the financial page, but in the research laboratory, a "behind the scenes" part of that industry.

Pressure brought upon one group often stimulates research in many others. The synthetic plastics and resins industries have significantly affected the economics of metals, wood, cement, and ceramics production. The steel companies have been required to bring their products to a higher degree of corrosion resistance, and heat and pressure strengths due to the oil industry's demand for pipe lines to resist corrosive soils, and tubes and tanks to resist high temperatures, pressures, and corrosion. These problems are due to the increasing number of automobiles and airplanes which in their turn require more and better fuel and lubricants to run them.

In its turn, chemical research in the oil industry has provided such materials as toluol for TNT, resins, plastics, and synthetic rubber, and motor fuels of such quality that the auto

motive and airplane industries must design better motors to use them efficiently.

Chemistry for years has been serving industry but the amount of this service has depended upon the intelligence of its management in visualizing and supporting this research. Today, many realize the import of research but the question is, how to organize and direct it to the greatest national advantage, since the proper utilization of natural resources depends upon the ability to convert them into products of the utmost value to our civilization.

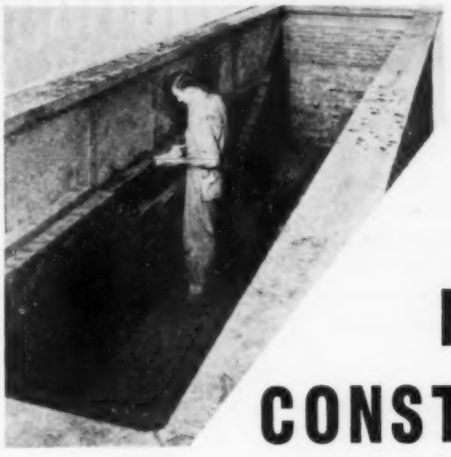
Construction Materials — The progress that has been made in the field of materials of construction in the past few years has been remarkable, according to James A. Lee, managing editor of *Chem. & Met.* Not only have such long established materials as cast iron and steel been subjected to changes by the addition of other elements, but the renowned stainless steels were almost unheard of not so many years ago. Even a short time ago, the most visionary engineers could not have foreseen that such materials as carbon, glass, silver and synthetic resins would be used so extensively for the construction of large scale equipment.

These changes have had a profound influence on the chemical industries. They have made available materials offering far greater resistance to corrosion. They have made it practical to operate at temperatures and pressures far beyond any previously considered possible.

Byproduct Recovery—The conversion of useless or nuisance wastes and byproducts into valuable commodities is naturally a subject of stirring appeal to aggressive management. Such activities, Lawrence W. Bass, assistant director of Mellon Institute, stated, have formed the basis of some of the most spectacular triumphs of modern technology. The total value of materials that have thus been salvaged from wastes amounts to many billions of dollars. Aside from their financial importance, these developments are of incalculable significance as contributions to human welfare and to the conservation of natural resources.

While great strides have been made in adapting byproducts and wastes to useful ends, the inherent possibilities for future developments are practically inexhaustible. Although chance discoveries and ideas have led to many successes in the past, it is now recognized that organized, systematic industrial research programs are the basic procedure for attacking these problems; an important part of the research budget of American industry is allocated to the quest for new uses. Such activities have been carried on with gratifying results by company, association, industry and government organizations. It is safe to say that the major part of the modern synthetic chemical industry has been evolved through research of this type.

SAVE DAYS



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TEMPERATURE RESISTANCE	To maintain its original effectiveness, the insulation you use must remain unaffected by the temperatures to which it is subjected. From the complete line of J-M Insulations, you can select the right material for any temperature from 400° F. below to 2500° F. above.	✓
CRUSHING STRENGTH	In locations where it is subjected to compressive loads, the insulation must be able to maintain its strength and true form, even while heated to service temperatures. For such services, the J-M line offers insulating materials with unusually high load-bearing capacities.	✓
BREAKING STRENGTH	Resistance to breaking is important in guarding against damage during transportation and installation. Certain services also demand more than ordinary toughness in insulations. Many J-M materials have unusually high resistance to breaking, as measured by transverse strength.	✓
FULL THICKNESS	For maximum insulating protection, the insulation you use must not sag or compress during application, or deteriorate in service. J-M Block and Pipe Insulations are designed to avoid such dangers . . . and they can be applied without risk of voids or thin spots.	✓
MOISTURE RESISTANCE	This feature is particularly important in refrigeration service, since moisture infiltration causes most low-temperature insulation failures. J-M Refrigeration Insulations offer unusual moisture resistance, and, because of their basically mineral composition, are rotproof and verminproof as well.	✓
STABILITY IN SERVICE	If maximum fuel or refrigeration savings are to continue indefinitely, the insulation you use must not only possess the above characteristics at the start, it must retain them throughout the life of the equipment on which it is used. The column at the left gives some brief facts on a few of the many J-M Insulating Materials.	

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Chem & Met BOOKSHELF

BITTER MEDICINE FOR BUSINESS

THE BOTTLENECKS OF BUSINESS. By *Thurman W. Arnold.* Published by Reynal & Hitchcock, Inc., New York. 335 pages. Price $2.50.

Reviewed by *S. D. Kirkpatrick*

MOST LAYMEN — engineers included — find it difficult to fathom the legal mind. Usually it is so effectively hidden behind complicated and confusing verbiage that it's difficult to find what it's all about. But here's a lawyer that writes differently. "Bottlenecks" is as clear and understandable as so much fairly intelligent conversation. And, like so much conversation, it has its faults as well as its virtues. There are many inaccuracies—some of inexcusably careless origin and others perhaps deliberately indefinite. There are unsupported generalities that the engineer is likely to question and sometimes resent, especially when used by the author as arguments for some of his pet theories of government and industry.

Here are a couple of samples: "There is no difference in motor fuels because they had become standardized. Competition had become a race to see which company could put out the most expensive hokum." All this, of course, was before the famous Ethyl Gasoline decision which, to the author's way of thinking, is making over or going to change the whole order of industrial marketing. For example, had it not been for this decision, he is certain that the duPont Company, with its nylon, would have succeeded "in destroying the manufacturers of other stockings without distributing the savings to consumers." Presumably he had never heard of the history of cellophane and rayon prices.

Another source of irritation, at least to this reviewer, is the frequent boasting about how the Department of Justice, especially with its consent decrees, has been able to scare manufacturers into cutting or holding down the prices for their products. "It is significant," Mr. Arnold writes, "that during the period when all commodities, the supply of which is affected by the war, were rising, the particular war products under investigation by the Department did not increase in price. It has been estimated that investigations of newsprint, potash, nitrogen and steel, which cost a total of about $200,000, has saved the consumers of this country $170,000,000." Given a few million, he could probably have saved most of our national income. But at whose expense? And how proud should we be of a bureaucracy that regards American industry as only "an economic feudalism masquerading under the name of democracy"? That boasts of its ability to make over directorates and management of American business to suit its own patterns and desires?

But just because this reviewer differs with the author in his economic philosophy, is no reason to condemn his book. Perhaps it should recommend it to most *Chem. & Met.* readers who would like to suffer a lively and enlightening irritation on the subject of "our whole economic system, its weaknesses and its strength, the 'bottlenecks' which tend constantly to obstruct the free flow of goods in our competitive system and, finally, the cost to all of us of these commercial and industrial infringements on our liberty."

PUMPS AND PUMPING

PUMPS. By *Frank A. Kristal* and *F. A. Annett.* Published by McGraw-Hill Publishing Co., New York, N. Y. 340 pages. Price $3.50.

Reviewed by *G. L. Montgomery*

ALTHOUGH PRIMARILY a description of designs of pumping equipment available for general pumping service, this book also briefly discusses some of the more important pumps designed for chemical plant service. Most of its pages, however, are devoted to simple, clear explanations of pumps suitable for handling water, oil and other non-corrosive, non-abrasive, or slightly corrosive or abrasive liquids. This fact makes the work a valuable addition to the chemical engineer's library, as most other texts on pumping for the process industries have stressed special problems, rather than general practice.

In addition to the pump descriptions, about one-third of the pages deal with such matters as priming, pipe sizes, head, operation, drives, pump selection, pump troubles and other practical matters for the plant operator.

MATERIALS HANDBOOK. Fourth edition. By *George S. Brady.* Published by McGraw-Hill Publishing Co., New York, N. Y. 591 pages. Price $5.

BRADY'S familiar little handbook has grown. From a page size of 4x6¾ in., the new edition has been increased to 5¾x9 in. and there has been a corresponding addition of new material.

For those who may be unacquainted with the book, it lists thousands of materials with such general information as chief characteristics, comparative data, sources, substitutes and uses.

The new edition has been brought up-to-date by the addition of many modern alloys, synthetic resins, chemicals and other materials which have been developed or become important since the previous edition was published. The number of newcomers to the pages of the handbook has necessitated a minor change in style which will be immediately apparent to those to whom the book is a familiar reference. Separate entries have been dropped in many instances. Examination shows, however, that practically all of the material is still present but has become a part of larger discussions under more general headings. For example, Aerocrete, instead of having a brief paragraph of its own, is now discussed under the general heading of Concrete. Similarly, Lautal, will be found with Aluminum-silicon alloys. This style of presentation often necessitates looking up a material twice, once in the book's index and once in the text. Advantages are that similar substances frequently may be compared as to properties. And, of course, such a system permits the inclusion of many new definitions and descriptions.

REACTION ACCELERATION

CATALYSIS, INORGANIC AND ORGANIC. By *Sophia Berkman, Jaque C. Morrell* and *Gustav Egloff.* Published by Reinhold Publishing Corp., New York, N. Y. 1,130 pages. Price $18.

Reviewed by *M. E. Clark*

WHAT IS CATALYSIS? Even the definition of the term is not established as an undisputed fact. The authors of this monumental work say, "Catalysts may be characterized best by defining their properties. They do not contribute energy to a reaction nor change the equilibrium point of a reversible reaction. They do not initiate reactions, but have an accelerating effect which, when combined with selectivity, may result in the ability to direct reactions. In addition to these general properties, catalysts may also have the ability of entering into a reaction over and over again by self-regeneration so that the catalyst is unchanged on completion of the reaction, small amounts of the catalyst thus being able to transform large quantities of the reacting substances."

Heretofore, the field of catalysis has been like a huge unmapped territory. A little exploring has been done here and a lot of investigating there, and many definite landmarks have been established, but there has been no correlation of all the known data into an organized pattern of knowledge. Dr. Egloff and his co-workers have assumed the role of the cartographer and have endeavored in this volume to piece together the published work of thousands of investigators and interpret it in the light of their own investigations.

The organization of the subject matter can best be shown by enumerating the chapter headings: the phenomenon of catalysis, adsorption and catalysis,

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heterogeneous and homogeneous catalysis, the activity of the catalyst, inhibitors in catalysis, promoters and poisons in catalysis, carriers in heterogeneous catalysis, catalytic reactions in inorganic and organic chemistry, physical conditions in catalytic reactions, classification of catalysts with respect to type of reaction, and catalysis in the petroleum industry.

There are many tables throughout the book, two of which are outstanding. In Chapter I and by way of introduction, a series of tables is presented which shows the intermediate compounds known or assumed to be formed in the course of certain reactions when specified catalysts are used. Reactions are classified as synthetic, decomposition, oxidation, hydrogenation, dehydration and "various" reactions.

The second and most important tabulation is in the chapter on classification of catalysts. It is 345 pages in length and really constitutes the heart of the volume. There are 18 parts to this section, each subdivided into short tables on specific reactions. The tables are all of the same form, giving the reaction, the catalyst and the reference. For example, under catalytic oxidation of ethanol, one of the listings is: oxidation of ethanol to CH_3COOH; under catalyst is listed "xylene"; and under observer is listed "Clamician and Silber, *Ber.*, **46**, 3894 (1912)."

In the last chapter, catalysis in the petroleum industry, the authors describe and present flow sheets of commercial catalytic processes. This information is surprisingly up to date for a technical book, much of it evidently written early in 1940. In addition to an unusually complete table of contents, the book contains complete author and subject indexes.

In the opinion of this reviewer, "Catalysis" is not a book which one sits down to read from cover to cover, but is rather a book which is first perused and then placed on the reference shelf to be consulted whenever a problem in catalysis presents itself. Undoubtedly the book will go a long way in helping to fulfill the authors' own prediction that "future research in the field of catalysis may be logically derived from the systematically presented facts instead of from the empirical methods used at present."

MANUAL FOR THE DESIGN OF FERROUS AND NON-FERROUS PRESSURE VESSELS AND TANKS. By *Karl Siemon*. Published by the author, Metuchen, N. J. 280 pages. Price $3.

Reviewed by *T. R. Olive*

THIS LITTLE MANUAL, compiled from many sources by the author and reproduced directly from the original drawings and typewriting by a photolithographic process, assembles a large amount of useful information between its covers and should prove valuable to all engineers who have occasion to design either pressure or non-pressure vessels. It may be argued by those

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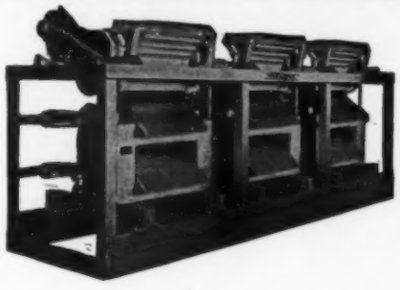

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thoroughly skilled in the art that the book contains little that cannot be found elsewhere in handbooks, codes, and the publications of manufacturers and boiler inspection agencies. This is true and yet there is certainly virtue in marshalling valuable data in a single place, particularly for those who do not deal constantly with the subject. It is felt that even old hands will find the volume well worth their possession.

Although marred by occasional typographical errors and debatable points, as well as by a reproduction process which has its limitations, the general appearance and presentation are good.

The book is in two parts, the first devoted to materials of construction, the second to vessel design. Materials dealt with include iron, copper, aluminum and nickel and their principal alloys.

The chapters on design recognize all important formulas that have been developed for stresses in various vessel elements and in some cases compare and evaluate them. A valuable feature of the book is the extension of the design data, largely developed for steel, to the calculation of alloy and nonferrous vessels. Another useful feature is the discussion based on the author's own experience of fabrication methods and construction details peculiar to the various non-ferrous materials. Numerous detail drawings add to the value especially of these latter sections.

TECHNICAL EXPOSITION. By *Leslie M. Oliver*. Published by the McGraw-Hill Publishing Co., New York, N. Y. 193 pages. Price $1.50.

COLLEGE COURSES in technical writing, to be taken following freshman English, would certainly improve much of the writing which is appearing today in technical journals. It was for just such a course that this textbook was prepared. And it appears to be entirely adequate for such a purpose. Divided into four parts, it takes up in order engineering English, research papers and reports, business letters, and vocabulary and punctuation.

Study of the material in the first 35 pages of the text and the chapters on technical papers, reports, and manuscripts would certainly repay anyone interested in obtaining greater clarity, accuracy and readability for his writings. Other sections on practice problems and letter writing are primarily for students and would be of minor importance to practicing chemical engineers and chemists.

MATERIALS OF CONSTRUCTION ADDENDUM

Through a misunderstanding, the name of the White Metal Rolling & Stamping Corp., Brooklyn, N. Y. was omitted from the list of manufacturers of Materials of Construction for Chemical Engineering Equipment, supplement to the September, 1940, issue. This concern supplies chemical lead and antimonial lead.

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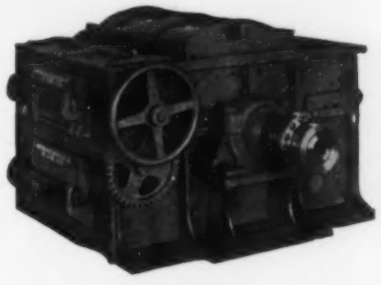

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Army Procurement of Supplies. Two recent Army Regulations, No. 5-100 and No. 5-220, dealing respectively with "General Provisions" and "Bid, Performance, Payment, and Patent Infringement Bonds," have been issued at 5 cents each.

Chemical Warfare Service—Officers' Reserve Corps. War Department, Army Regulations No. 140-26; 5 cents.

Medical Field Manual, Field Sanitation. War Department, FM 8-40; 25 cents.

Technical Manual, Military Explosives. War Department, TM 9-2900; 20 cents.

Lubricating Oil, General Information, Requirements and Methods of Test. Navy Department, Bureau of Ships; 5 cents.

Directory of Governmental Consumer Services and Agencies, by Leland J. Gordon. Available from Office of the Consumer Adviser, National Defense Commission, Washington, D. C.; mimeographed.

Digest of Decisions of the Federal Trade Commission, From 1915 to June 1, 1938. Federal Trade Commission; 10 cents.

List of Commercial Standards, Revised to October 1, 1940. National Bureau of Standards, Letter Circular 609; mimeographed.

Financial Statistics. The Federal Trade Commission has issued additional industrial corporation reports covering the following manufacturing corporations: Coke-oven products; corn products; food specialty; glass and glassware. Available from Federal Trade Commission, Washington, D. C.

Minerals Yearbook 1940. During late November the Government Printing Office was beginning to take orders for the annual volume of mineral statistics issued by the Bureau of Mines, although the actual date of release was not known. Priced at $2 per copy.

Active List of Permissible Explosives and Blasting Devices Approved Prior to June 30, 1940. Bureau of Mines, Report of Investigations 3533; mimeographed.

Hurricane Floods of September 1938, by Carl G. Paulsen et al. U. S. Geological Survey, Water-Supply Paper 867; $1.25.

Industrial Reference Service. The Bureau of Foreign and Domestic Commerce now issues in various parts statistical and information items formerly published in mimeographed news letters or periodic publicity items. This material is now supplied to those interested on a subscription basis, the price for each part being $1 except two sections (foodstuffs and machinery) which are $2 and the chemical section which is $4 per year. Subscriptions should be addressed to the Bureau of Foreign and Domestic Commerce, Washington, D. C. The entire set of the following 14 parts is supplied for $15 per year.

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13.—Tobacco and Its Products
14.—Special Products (including amusement, athletic and sporting goods; fire arms; musical instruments; brooms; brushes; toilet wares; fire extinguishers and safety devices; graphic arts; jewelry; mortuary; notions and novelties; scientific and professional goods; optical goods; photographic materials; toys.)

TNEC Monograph Studies. The Temporary National Economic Committee is now beginning to release a series of monographs prepared by experts in various Government agencies and economists on the TNEC staff. Of the 43 identified in the official press announcement, the following 8 had actually been announced as available before Thanksgiving:

Monograph 1.—Price Behavior and Business Policy (45 cents)
2.—Families and Their Life Insurance (25 cents)
3.—Who Pays the Taxes? (10 cents)
4.—Concentration and Composition of Individual Incomes (15 cents)
5.—Industrial Wage Rates, Labor Costs and Price Policies (25 cents)
6.—Export Prices and Export Cartels (Webb-Pomerene Associations) (35 cents)
10.—Industrial Concentration and Tariffs (25 cents)
14.—Hourly Earnings of Employees in Large and Small Enterprises (15 cents)

Those desiring to secure further information can get a complete list of the prospective documents from Temporary National Economic Committee, 281 Apex Building, Washington, D. C. Those published should be purchased as usual from the Government Printing Office.

RECENT BOOKS and PAMPHLETS

Chemical Engineering Problems, 1940. Prepared by Projects Committee of the Chemical Engineering Education Committee. Published by American Institute of Chemical Engineers, New York, N. Y. 40 pages. Price 10 cents. This supplement to the Transactions of the A.I.Ch.E. is the second list of problems collected by the Projects Committee. There are numerous real chemical engineering problems in each of nine of the important unit operations. As in the previous list, neither answers nor names of those contributing problems are given.

Chemical Engineering Catalog, 1940. Published by Reinhold Publishing Corp., New York, N. Y. 1,097 pages. An annual publication giving data on equipment, machinery, laboratory supplies, heavy and fine chemicals and raw materials used in the industries employing chemical processes of manufacture. Also included are classified and cross-reference indexes of such equipment and materials. The technical and scientific books section has been brought up to date to give a practically complete list of books in English on chemical and related subjects.

Proceedings of the Sixteenth Annual Convention of National Fertilizer Association. Published by the Association, Investment Bldg., Washington, D. C. This is the customary resume of technical and economic articles presented at the annual convention of National Fertilizer Association.

Warenverzeichnis der Chemischen Industrie des Deutschen Reichs. The 20th edition of Wenzels Directory. Published by Urban & Schwarzenberg, Berlin, NW 7, Germany. A directory of German manufacturers of chemicals and producers of raw materials classified according to products and also by plant location. Also included is an alphabetical index in four languages.

Aircraft Engines, Vol. 1. By A. W. Judge. Published by D. Van Nostrand Co., New York, N. Y. 380 pages. Price $5.50. First of two volumes on aircraft engines. A British book which presents principles and results of research on internal combustion engines. Among the subjects discussed are thermodynamics, performance, the combustion process, fuels and fuel systems, supercharging and cooling, and engine temperatures.

A *Permanent Seal* COSTS NO MORE WHEN MADE WITH *Walseal*

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The Walseal Silbraz fitting is a threadless bronze fitting with the brazing alloy—Sil-Fos—incorporated as a ring in each opening. Piping can be assembled in its permanent location and Silbraz joints made by heating the pipe and Walseal Silbraz fitting with an oxyacetylene flame. A simplified technique for heating enables mechanics rapidly to install silver-brazed joints in piping installations at a remarkably low cost. A permanent seal costs no more when made with Walseal. **Walseal Silbraz joints are braze welded—not soft soldered.**

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MANUFACTURERS' LATEST PUBLICATIONS

Publications listed here are available from the manufacturers themselves, without cost unless a price is specifically mentioned. To limit the circulation of their literature to responsible engineers, production men and industrial executives, manufacturers usually specify that requests be made on business letterhead.

Air Cleaning. Westinghouse Electric & Mfg. Co., Dept. 8N48, East Pittsburgh, Pa.—Folder F-8501—4 pages on the design and application of this company's Precipitron electrostatic air cleaner.

Air Conditioning. Carrier Corp., Syracuse, N. Y.—Publications as follows: Bulletin 53C-5, Describes this company's automatic, self-contained, silica, gel dehydrator for gas or steam activation, with information on construction and dimensions; 46J-4, 4 pages on gas-fired unit heaters; CR-157-Rev., 2-page leaflet on Type 15M cold diffuser, a fan-operated, suspended type.

Alloys. Aluminum Company of America, Pittsburgh, Pa.—Form AD-42—90-page loose-leaf booklet on aluminum casting alloys with information on choice of materials, types of alloys, foundry principles, design of castings, and description of alloys.

Alloys. Rustless Iron & Steel Corp., Baltimore, Md.—24-page book describing this company's newly enlarged plant for stainless steel manufacture, containing many illustrations of new facilities.

Blowers. Roots-Connersville Blower Corp., Connersville, Ind.—Bulletin 21-B-35—8 pages describing Victor Acme rotary positive blowers, with information on construction and performance.

Chemicals. Carbide & Carbon Chemicals Corp., 30 East 42d St., New York, N. Y.—Form 4372—95-page 10th edition of this company's book on synthetic organic chemicals, covering in considerable detail properties and uses of some 150 chemicals made by this company. Arrangement is in logical order, with such groupings as alcohols, glycols, ethers and oxides, esters, penetrants, resins, etc. In addition to properties of individual chemicals, the book discusses group characteristics. Inclusive product and application tables and tables of useful information complete the compilation.

Chemicals. Manufacturing Div., The Edwal Laboratories, Inc., 732 Federal St., Chicago, Ill.—15-page booklet describing this concern's services in the confidential production of small lots of new or unusual organic chemicals for those requiring them; also list of chemicals regularly supplied by this company with information on specifications, uses, shipping and packing.

Chemicals. Glyco Products Co., 148 Lafayette St., New York, N. Y.—New bulletin describing properties of 80 new esters of polyhydric alcohols, and their ethers. Information arranged in tabular form for ready accessibility.

Compressors. Chicago Pneumatic Tool Co., 6 East 44th St., New York, N. Y.—Bulletin 726—30 pages, discussing improvements in construction of this company's two-stage horizontal, duplex, motor-driven compressors, in capacities from 350 to 10,000 cu.ft. per min., for pressures from 80 to 125 lb.

Compressors. Worthington Pump & Machinery Corp., Carbondale Div., Harrison, N. J.—Bulletin C-1100-B11—6 pages on vertical two-cylinder refrigeration compressors, sizes 5x5 in. and smaller.

Crushers. Traylor Engineering & Mfg. Co., Allentown, Pa.—Circular 1005—4 pages discussing advantages encountered in the use of this company's specially shaped bell head fittings in gyratory crushers; and curved jaw plates in jaw crushers.

Electrical Equipment. General Electric Co., Schenectady, N. Y.—GEA-2553—4-page leaflet briefly describing various types of industrial instruments and automatic time switches made by this company. Also GEA-3020A, 4 pages on this company's portable electrostatic voltmeter for high voltage measurements, for example, in studying generation of static by moving belts or flowing liquids.

Electrical Equipment. Westinghouse Electric & Mfg. Co., Dept. 7N20, East Pittsburgh, Pa.—Application Data 49-060—19-page book on the application of capacitors on industrial-plant electrical circuits, with information on theory and with formulas, tables and engineering data for permanent reference use of plant engineers.

Equipment. S. Blickman, Inc., Weehawken, N. J.—4-page leaflet briefly describing types of stainless steel equipment for process industry use, fabricated by this company.

Equipment. Marco Co., 5325 Westminster Ave., Philadelphia, Pa.—8-page leaflet describing this company's Flow-Master line of liquid treating equipment including a sanitary pump, an homogenizer and a "Kombinator," the last a machine for grinding, mixing, blending, emulsifying and stabilizing in one operation.

Equipment. Morse Bros. Machinery Co., 2900 Broadway, Denver, Colo.—Bulletin 4013—4-page bulletin briefly describing laboratory crushing and grinding equipment, feeders, ball mills, flotation cells, filters, concentrating tables and other equipment made by this company.

Filters. Swenson Evaporator Co., Harvey, Ill.—Bulletins F-100 and 101—4-page leaflets describing in considerable detail, respectively, this company's rotary drum vacuum filters, and top-feed vacuum filter dryers.

Finishing. Sherwin - Williams Co., Cleveland, Ohio—Vol. 1, No. 1 of a new publication, "What's New in Industrial Finishing," giving brief articles designed specifically for users of industrial finishes.

Furnaces. W. S. Rockwell Co., 50 Church St., New York, N. Y.—Bulletin 403—4 pages on this company's electric and fuel-fired car type furnaces for stress relieving and heat treatment.

Heat Exchange. American Brass Co., 25 Broadway, New York, N. Y.—Publication B-2, Fifth Edition—58-page bulletin on this company's tubes and plates for condensers and heat exchangers, with information on alloys used, manufacturing methods, applications, installations, specifications and physical properties. Includes extensive section of useful data, such as Mollier chart and steam tables.

Heat Transfer. Thermek Corp., 105 West Adams St., Chicago, Ill.—Bulletin 440—24 pages on this company's integrally splined, extended-surface tubing and other heat transfer elements, with information on performance; and typical applications in air conditioning, heating, cooling, heat exchange and condensation.

Instruments. American Instrument Co., 8010 Georgia Ave., Silver Spring, Md.—Bulletin 2084—8 pages completely describing the Tuckerman optical strain gage for the precise measurement of tension and compression strains as small as 0.000002 in.

Instruments. Brown Instrument Co., Philadelphia, Pa.—Catalog 2007—28-page bulletin describing in detail this company's electric flowmeters; also Catalog 6706, 20 pages on this company's recording and indicating thermometers and pressure gages.

Instruments. The Foxboro Co., Foxboro, Mass.—4-page article by Mr. R. A. Rockwell, entitled "Pneumatic vs. Mechanical Throttling Range," a technical comparison of these two methods of operating controllers.

Jacks. Templeton, Kenly & Co., 1020 South Central Ave., Chicago, Ill.—Catalog 40—60-page pocket-sized booklet describing jacks for every type of use, including geared and screwed types, tank supports, etc.

Level Controls. Fred H. Schaub Engineering Co., 325 West Huron St., Chicago, Ill.—Catalog 640-M—12 pages on this company's new line of Magnetrol liquid level controls in various types, based on principle of magnetic transmission between float and switch without use of a stuffing box.

Lighting. Westinghouse Lamp Div., Bloomfield, N. J.—New manual on the design of fluorescent lighting systems, with information on various levels of illumination, correct mountings and structural details, giving examples and design sketches as well as general lighting precautions, with remedies and suggestions. Manual available from this company's advertising and sales promotion department at cost of 7 cents per copy.

Materials Handling. Economy Engineering Co., 2653 West Van Buren St., Chicago, Ill.—32 pages on this company's lifting and hoisting devices including hand- and electrical-powered portable and stationary lifters of various types.

Materials Handling. The Elwell-Parker Electric Co., 4205 St. Clair Ave., Cleveland, Ohio—Catalog A 8153—12 pages on the use of electric industrial trucks, discussed from the standpoint of seven typical steps common to most industries, from the point of receiving raw material to the shipment of finished product.

Proportioners. Proportioneers, Inc., 9 Codding St., Providence, R. I.—Bulletin TOU-6—Describes this company's complete line of automatic treating, feeding, diluting, blending, proportioning and sampling equipment for chemical process operations; also for water treatment.

Pumps. International Nickel Co., 67 Wall St., New York, N. Y.—16-page booklet on practical pumping problems and how they are solved through the application of Monel, K Monel and S Monel for the pump parts. Discusses service of different types of pumps and gives case histories.

Pumps. Lawrence Machine & Pump Corp., 371 Market St., Lawrence, Mass.—Bulletin 208-2—4-page leaflet on this company's standard dredging pumps for heads up to 100 ft., suitable for various sorts of abrasive pumping service, such as handling of ashes and cinders.

Pumps. Leyman Mfg. Corp., John H. McGowan Co. Div., Cincinnati, Ohio—Bulletin TP-1—6 pages describing in considerable detail features of this company's water-lubricated deepwell turbine pumps, in capacities to 5,000 g.p.m.

Refractories. The Babcock & Wilcox Co., 85 Liberty St., New York, N. Y.—Bulletin R-2-G—New bulletin on insulating firebrick, giving information on advantages and applications in a wide variety of industrial furnaces.

Refractories. The Carborundum Co., Perth Amboy, N. J.—Form 5108—76-page catalog on this company's refractories for heavy-duty service, with information on various types including silicon carbide, fused aluminum oxide, mullite and aluminum silicate. Includes refractory cements. Gives information on physical and refractory properties and standard sizes, and includes tables of useful information.

Regulators. Foster Engineering Co., 109 Monroe St., Newark, N. J.—8-page leaflet describing this company's single- and double-seated air-dome-loaded pressure-reducing regulators for steam, hot liquids and hot gases, for initial pressures to 2,500 lb., delivery pressures to 1,200 lb. and temperatures to 1,000 deg. F. Springs, weights and stuffing boxes are eliminated.

Valves. Hauck Manufacturing Co., 124 Tenth St., Brooklyn, N. Y.—Bulletin 704—Leaflet describing this company's Micro-Cam oil valve for oil burner control, for 1.1 to 100 gal. per hr. capacity at 1 lb. pressure drop on Bunker C oil at 180 deg. F.

Ventilators. American Larson Ventilating Co., Keystone Bldg., Pittsburgh, Pa.—Bulletin A.I.A.12k1—16-page engineering discussion of this company's roof ventilator with information on construction, performance at various wind velocities, and development of formulas.

CONSUMPTION OF CHEMICALS HOLDS ABOVE THE HIGH LEVELS REACHED LAST YEAR

Chem & Met ECONOMICS and MARKETS

WHILE the volume of chemicals consumed in domestic manufacturing industries fell off in November from the record figure reported for the preceding month, an unusually high operating rate was maintained which in some instances was above the October level. Steel mills set the pace which was on a continued upward trend and rayon and textile plants worked at or near capacity. Petroleum refineries, however, cut down on runs to stills and some of the other industries, partly because of a reduction in working days, cut down consumption of raw materials. The preliminary

Chem. & Met. Index for Consumption of Chemicals

	September revised	October
Fertilizer	26.10	31.49
Pulp and paper	19.92	20.80
Petroleum refining	14.08	14.36
Glass	13.68	14.03
Paint and varnish	11.50	12.72
Iron and steel	11.50	12.39
Rayon	11.30	12.78
Textiles	8.15	10.07
Coal products	9.32	9.42
Leather	4.23	4.27
Explosives	5.43	5.49
Rubber	2.90	3.30
Plastics	2.93	3.16
	141.04	154.28

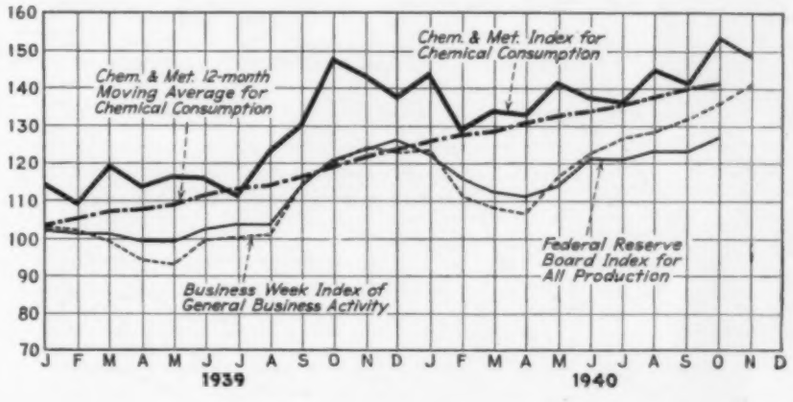
index for consumption of chemicals for November is 150 which compares with 154.28 for October and with 143.50 for November last year.

Late figures for manufacturing operations in October forced an upward revision of the preliminary index and proved that the month had set an all-time high for domestic consumption of chemicals. Every industry listed in the index contributed to the increase with textile mills especially prominent because of larger use of all fibers. Paint and varnish sales were larger than for any month of the year except May. Production of pulp increased to 757,400 tons and incidentally pulp production has been important this year in increasing consumption of chemicals in the pulp and paper fields. Steel output has been running at record totals and different branches of the glass industry have maintained high operating rates. Rayon production and consumption is on the way to surpass last year's record figures and rubber consumption, crude and reclaimed, also is on the record list. In the plastics field, some products have lost out in certain markets but the loss has been more than made up by increased use of other grades of plastics.

In addition to enlarged domestic consumption, production of chemicals has been stimulated by the larger amounts which have been going to markets abroad. Export shipments in October were not so large as those for the months immediately preceding but reached a total of $17,596,783 which brought the 10-month figure up to $185,734,116. This is approximately 44 per cent above the like 1939 figure of $128,383,839. Judging from the present status of the export market and the large shipments made in the final months last year, export shipments for the 12 months will exceed the 1939 total of $164,657,796 by about 33 per cent.

Toluol has figured prominently in export trade this year with October shipments amounting to 4,931,453 lb. and the 10-month total being 47,860,236 lb. Comparable figures for 1939 are not available. Coal-tar dyes also have come in for foreign buying with shipments for first 10 months at 21,114,572 lb. as against 9,147,479 lb. for the corresponding 1939 period. Foreign buying of chemical specialties has been active in the case of copper sulphate and it is reported that numerous buying orders were not filled. Shipments for the Jan.-Oct. months totaled 45,432,771 lb. compared with 21,596,950 lb. last year. In the industrial chemical group, a disappointing showing has been made by the sodium compounds with the 10 months total of 545,288,142 lb. for last year dropping to 503,743,465 lb. this year.

Domestic production of chemicals likewise has been aided by the relative scarcity of imported materials. Imports in October fell to a valuation of $3,435,903 compared with $6,343,148 in October last year. This condition not only encouraged enlarged outputs of domestic chemicals but also was responsible for the establishment of domestic production of some coal-tar intermediates, chlorate, sulphate, and cyanide of potash.

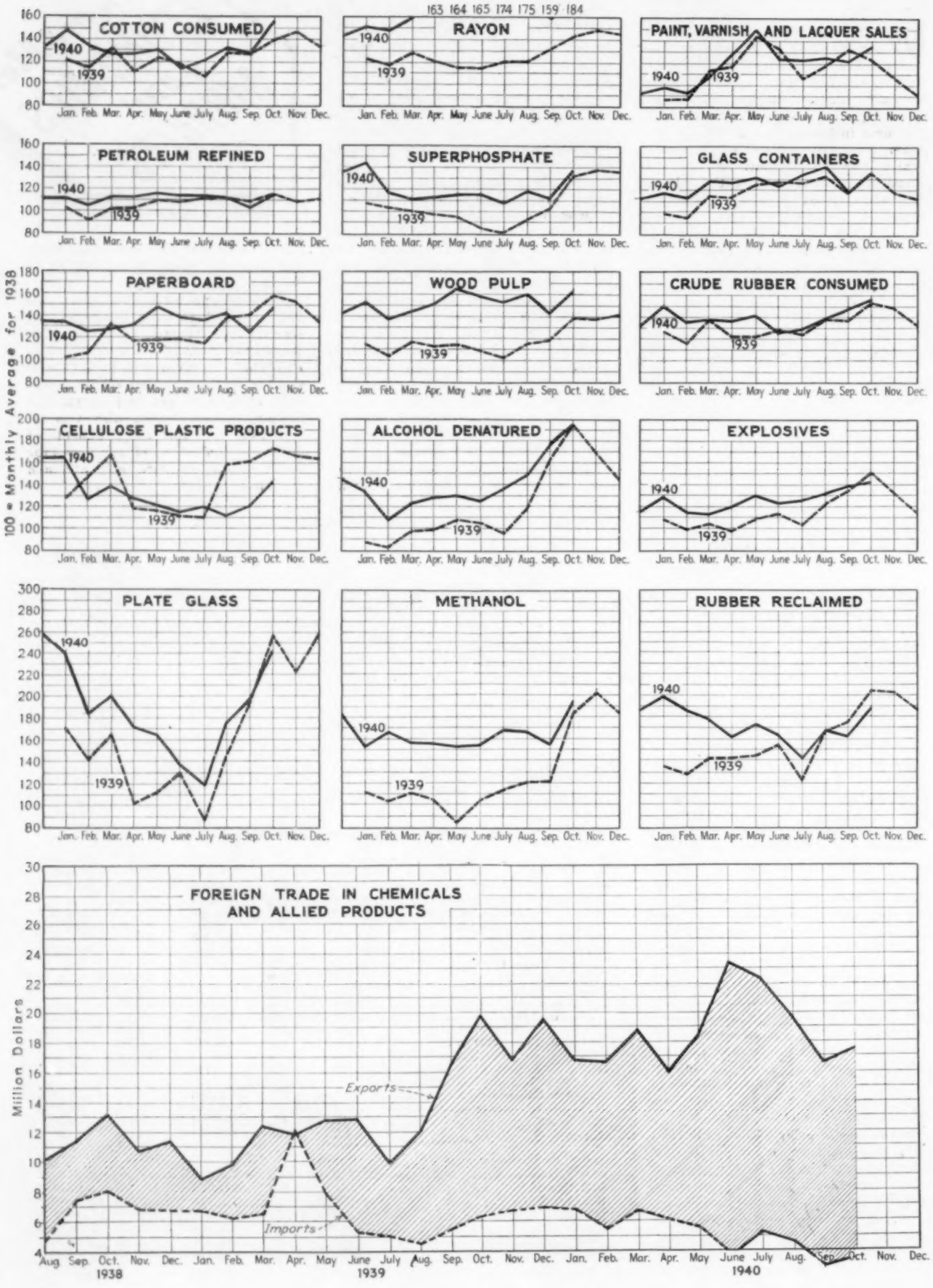


Production and Consumption for Chemical-Consuming Industries

	October 1940	October 1939	January-October 1940	January-October 1939	Per cent of gain for 1940
Production					
Alcohol, ethyl, 1,000 pr. gal	23,350	20,963	207,822	171,973	20.8
Alcohol, denatured, 1,000 wi. gal	15,098	15,181	108,864	89,698	21.4
Ammonia, liquor, 1,000 lb	5,141	4,783	46,344	38,493	20.4
Ammonium sulphate, tons	63,806	59,434	589,967	459,714	28.4
Benzol, 1,000 gal	12,193	11,151	108,356	81,604	32.8
Byproduct coke, 1,000 tons	4,840	4,512	44,220	33,627	31.5
Naphthalene, 1,000 lb	6,597	5,099	[1]	38,001	....
Toluol, 1,000 gal	2,419	2,080	[1]	15,501	....
Glass containers, 1,000 gr	4,864	4,891	45,709	42,881	6.6
Plate glass, 1,000 sq. ft	17,070	18,369	130,821	107,451	21.7
Window glass, 1,000 boxes	1,349	1,121	10,956	8,445	29.7
Methanol, crude, 1,000 gal	463	463	4,342	3,746	15.9
Methanol, synthetic, 1,000 gal	4,408	4,158	36,615	25,460	43.8
Nitrocellulose plastics, 1,000 lb	1,096	1,315	9,746	10,923	10.8*
Cellulose acetate plastics, 1,000 lb.					
Sheets, rods and tubes	983	713	7,086	7,429	4.6*
Molding composition	1,926	1,410	11,922	9,273	28.6
Paperboard, tons	473,169	506,466	4,324,204	3,970,722	8.9
Rubber reclaimed, tons	19,358	19,549	172,615	152,732	13.0
Consumption					
Cotton, bales	770,702	686,936	6,488,329	6,000,004	8.1
Silk, bales	39,877	41,858	253,380	330,062	30.3
Wool, 1,000 lb	50,627	45,258	321,715	330,596	2.7*
Explosives, 1,000 lb	37,740	40,612	338,766	306,414	10.6
Paint, varnish, lacquer, $1,000	39,179	35,828	352,315	337,226	4.5
Rubber, crude, tons	56,477	57,155	507,411	477,484	6.3
Rubber reclaimed, tons	16,528	17,423	154,826	146,120	5.9

* Per cent of decline. [1] Not available.

Production and Consumption Trends



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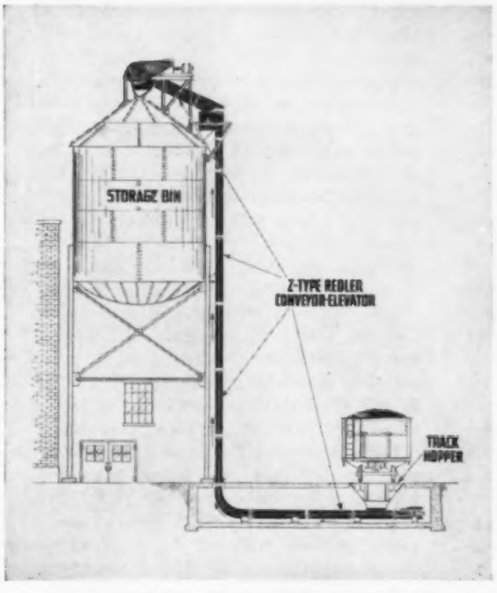

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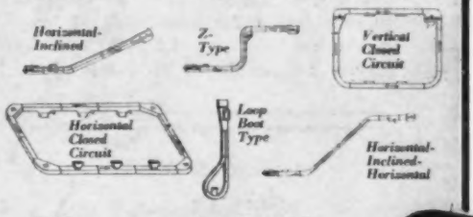

Right—phantom drawing of L-type REDLER showing how gentle en masse action moves bulk materials smoothly, eve around bend corners.

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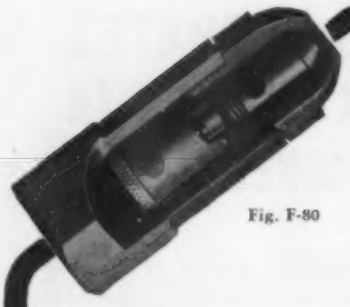

Fig. F-80

STAINLESS STEEL:
Available in capacities from .0095 G.P.M. (Fig. F-80 style illustrated) to 104 G.P.M. (Fig. B-8-A style).
"Hollow" cone, "Solid" cone, and "Flat" sprays furnished in pipe sizes and capacities to suit practically any problem where corrosive liquids are sprayed.

STONEWARE:
Monarch Fig. 6020 and Fig. 6040 stoneware sprays have replaced most other types of nozzles used in acid chamber plants throughout the world. Last almost indefinitely in sulfur gases and will not break or crack from temperature changes.

HARD RUBBER
Patented Fig. B-27 nozzle is of the "non-clog" type; i.e. it contains no internal vanes, slots, or deflectors which might facilitate clogging. Available ¼" to 1" pipe. Small sizes produce a very fine, soft, wide angle hollow cone spray, even at low pressures.
Fig. H-407 "flat" spray produces a relatively fine even sheet of liquid.

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CONTRACT PLACEMENTS AND PRICES CONTINUE AS HIGH SPOTS IN MARKET FOR CHEMICALS

INTEREST in the market for chemicals of late has centered mainly in the placing of orders for future delivery and in the prices which will prevail for 1941 contracts. The trend of prices recently has been upward and a moderate increase is shown in the average level as compared with that existing this time last year. Considering that some raw materials are higher in price, that labor and other producing costs have advanced, and that the increase in consuming demand has lessened competitive selling, the rise in prices for chemicals is noteworthy inasmuch as it has been of minor proportions and has extended to relatively few commodities. Among the items for which higher prices apply are some of the chemical solvents, spirits of turpentine, basic carbonate of lead, zinc oxide, cream of tartar, tartaric acid, and lead oxides. These comparisons are made on a basis of current prices and those in effect at this time last year. The effect, however, is that the average level for first quarter deliveries will be somewhat higher than for the 1940 period.

More important is the fact that such heavy tonnage chemicals as mineral acids, alkalis, chlorine, bichromates, ammonia compounds, carbon black, and many of the potash chemicals have had sales prices extended to cover forward deliveries. It is also noted there have been very few soft spots in the market. Caustic soda appears to have suffered from an oversupply of stocks and second hands have been offering at attractive prices and increased production of phenol has brought out some sales pressure with a consequent lowering in values. With these exceptions the market has been firm and with a continuance of heavy consuming demand in prospect, the probabilities appear more favorable for a strong market rather than any recession in values. Most of the contracts placed carry provisos for price adjustments at the end of the quarter and in some cases contracts have been written with maximum prices established but with payments to be made at the level prevailing at time of shipment, the maximums merely protecting buyers against excessive advances.

In contrast to the firm position of chemicals has been the low price level at which vegetable oils and animal fats have been offered. These materials are more susceptible to conditions prevailing in world markets and the closing of some of the important consuming markets abroad has made larger amounts available to the remaining markets and in addition domestic production of these materials has been on an advancing scale and large stocks, especially of fats have been overhanging the market. Until there has been a change in the statistical position, price recoveries may prove to be spasmodic.

In considering prices for chemicals, some distinction must be made between spot trading and deliveries against contracts. Most large consumers have been receiving supplies at uniform prices but buyers in the spot market have been forced to shop around to find stock of certain chemicals and usually have had to deal at private terms. This also has been true for some buying for export and because inquiries were for materials which were in limited supply the prices asked were correspondingly high. For instance there has been a good demand for bichromates for export and while production has been increasing—production of bichromates and chromates in 1939 has just been announced at 56,385 tons—the greater part of output was sold ahead. In order to enable producers to act more freely in export trade, particularly to fill requirements in South America, arrangements were made in November to relax export license control on shipments of chrome ore. Domestic producers of bichromate will be authorized to import ore not usable for defense metals under the assurance that they will be granted export licenses for the chrome salts. Chrome ore thus imported, however, must be earmarked and full records maintained.

The Bureau of Customs has ruled that "a processing of ore which segregates therefrom a part of the nonmetallic substances without any change in the native character of the metallic elements is not a manufacturing process and may be done in the foreign trade zone, or under the provisions of Section 562 of the Tariff Act of 1930, as amended." This gives somewhat greater freedom for upgrading of ores than previously allowed, an authority which some chemical enterprises may be able to use on occasion.

Red oxide of iron exports continue to be average notwithstanding current conditions. Malaga, which is the production center for red oxide of iron, in August shipped 1,167,401 lb. of ground red oxide of iron valued at

CHEM & MET.
Weighted Index of
CHEMICAL PRICES

Base=100 for 1937

This month	**99.64**
Last month	99.53
December, 1939	98.86
December, 1938	98.92

Some of the chemical solvents were advanced in price but spirts of turpentine dropped below the level of a month ago. Contract prices for numerous chemicals have now been extended to cover first quarter deliveries.

$21,667, which brought the total amount exported to the United States during the first 8 months of 1940 to 8,794,278 lb. valued at $156,888.

Export trade in chemicals and allied products has tapered off considerably but still remains far above the normal standards of recent years. The accompanying tabular presentation gives the totals for the various groups for the first ten months of the year with comparisons for the corresponding period of last year.

Chemical Exports By Groups

	Jan.–Oct. 1940	Jan.–Oct. 1939
Coal tar products	$24,070,386	$10,997,796
Medicinals	24,145,262	17,630,508
Chemical specialties	32,069,026	28,298,852
Industrial chemicals	44,228,482	26,991,238
Pigments and paints	19,092,399	18,375,238
Fertilizers	16,750,754	14,463,430
Explosives	18,223,483	3,426,348
Soap	2,334,299	2,642,693
Toilet preparations	4,820,025	5,557,736
	$185,734,116	$128,383,839

The Department of Commerce reports that the United States no longer depends upon European industry for its supplies of potassium hydroxide. In 1929 the United States imports of potassium hydroxide had a foreign valuation of $1,000,000, but the trade by 1939 had declined to 332 short tons, valued at $62,000. There are now five domestic plants producing caustic potash with a combined output in 1939 of 13,856 short tons, almost 50 per cent over the quantity reported for 1935, About one-third of the production is employed in the manufacture of soap. A substantial share of the remainder is used in the manufacture of other chemicals.

Exports statistics for caustic potash, heretofore not separately reported, will be shown in a separate classification commencing with the trade for January 1941.

Butyl alcohol shipments from Puerto Rico to the United States during the first nine months of 1940 totaled 1,038,600 lbs. Production during the three-quarter period totaled 645,120 lb. and stocks on hand at the end of September amounted to 77,400 lb.

CHEM & MET.

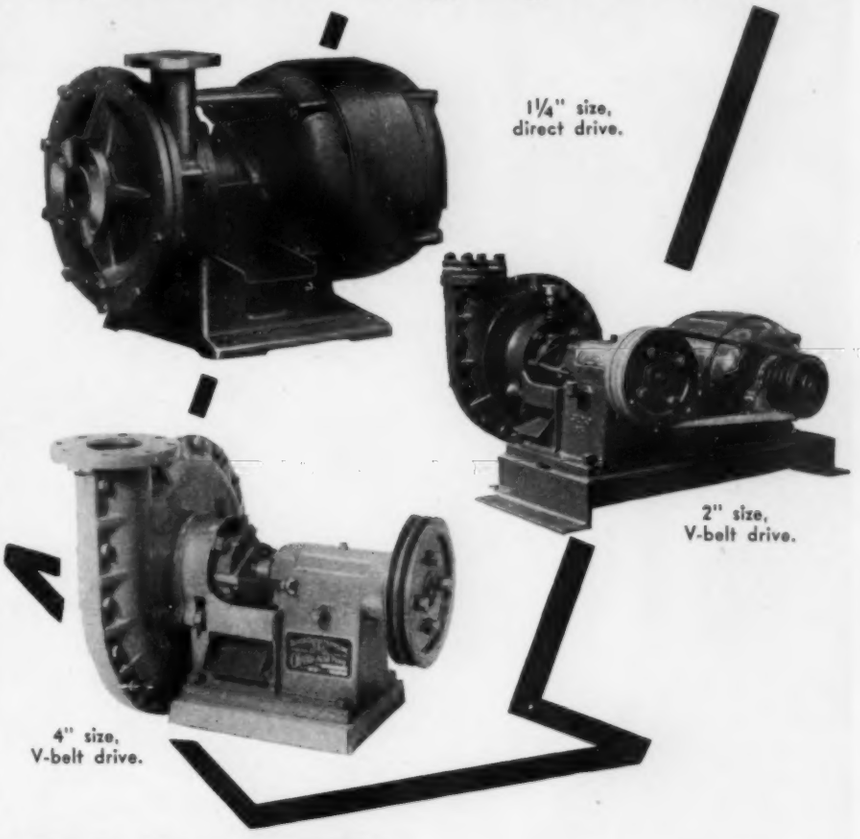
Weighted Index of Prices for OILS & FATS

Base=100 for 1937

This month	**68.94**
Last month	68.79
December, 1939	78.25
December, 1938	72.21

Denatured olive and olive foots are scarce and nominal. Other oils showed but little price change during the month. Soybean oil moved up when beans rose in price but the oil eased off. Tallow sold at higher levels.

To Reduce Pumping Costs, Use



OLIVITE

Acid-Handling Pumps because they are Strong, Durable, Non-Shatterable and Efficient

STRONG because all pumping parts are of heavy metal.

DURABLE because all pumping parts are protected by OLIVITE, a special highly-resistant compound firmly bonded to the metal. Neither hot nor cold liquids affect this bond or compound.

NON-SHATTERABLE because there's nothing brittle about the pump.

EFFICIENT because the design of this centrifugal pump is as advanced as any.

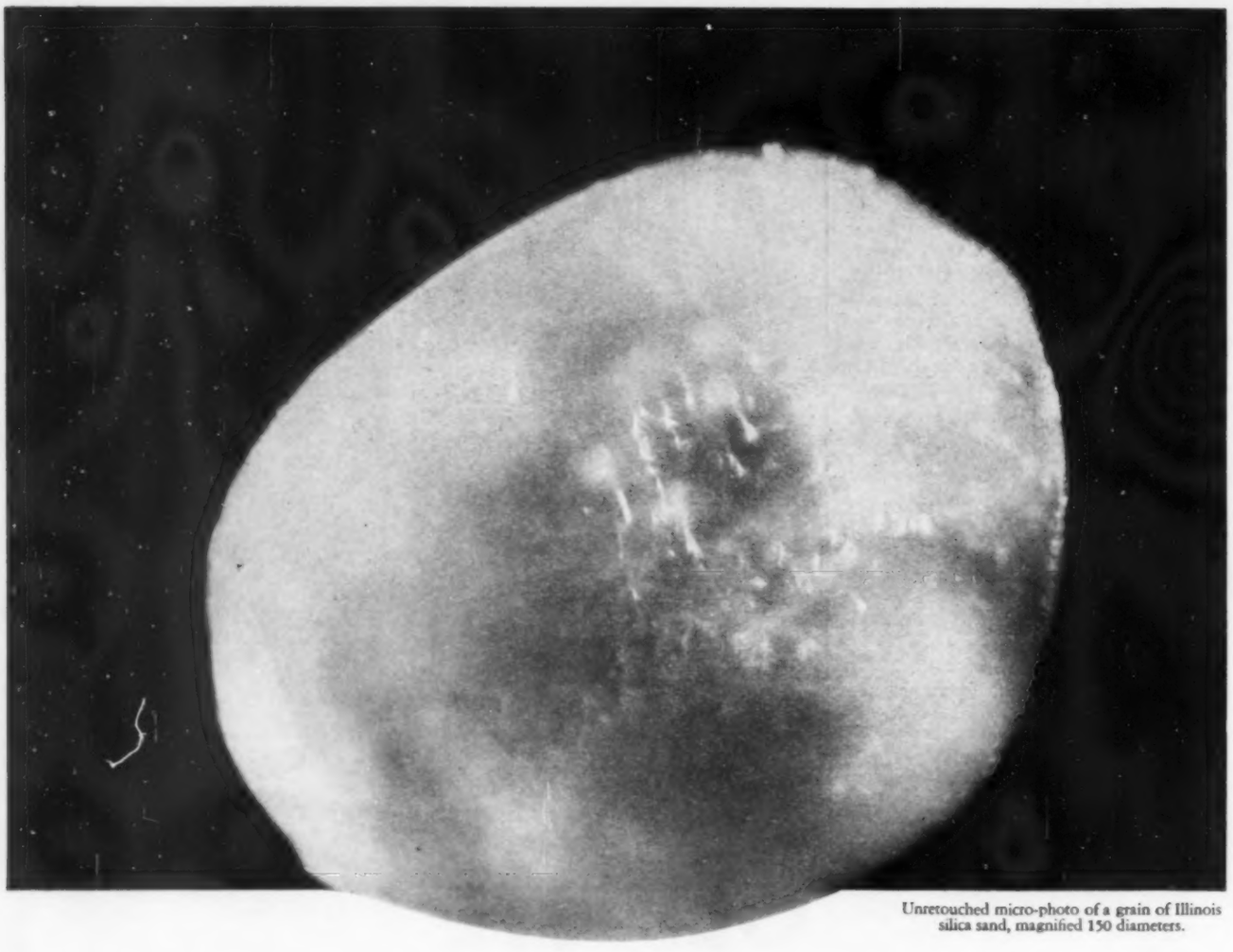
LEAK-PROOF because the floating stuffing box, spring-tensioned gland and lantern ring keep liquids where they belong.

Three sizes: 1¼, 2 and 4-inch, each with flat, V-belt or direct drive. Bulletin 302 gives full details. Send for a copy.

OLIVER UNITED FILTERS INC.

NEW YORK, N. Y. 33 West 42nd St. CHICAGO, ILL. 221 N. LaSalle St. OAKLAND, CALIF. 2900 Glascock St.

Factories: Hazleton, Pa.—Oakland, Calif.—Orillia, Ont.



Unretouched micro-photo of a grain of Illinois silica sand, magnified 150 diameters.

99.89% Pure Silica

Sand testing as high as 99.89% pure silica is found in large deposits in Illinois. Exceptionally free from injurious elements, it is preferred by many manufacturers of glass products because of the greater uniformity and freedom from discoloration of the glass made from it. The huge reserve of such high quality silica sand in Illinois is an important consideration to manufacturers who are planning a new glass plant or branch plant. Savings in freight costs resulting from locating near silica sand deposits are an important profit factor in glass manufacturing.

Other production and marketing advantages will be gained by locating your new plant or branch plant in Illinois. Natural gas, piped from southwest oil fields, is available at very low rates in silica sand producing regions. Low cost Illinois coal, obtainable close at hand, yields low cost producer gas. A large market for plate glass, window glass, glass tableware, bottles, containers, and other glass products, is at the door of manufacturers who locate in Illinois. For the complete story of Illinois silica sand and the advantages and opportunities Illinois offers the Glass Industry, write—

ILLINOIS DEVELOPMENT COUNCIL
STATE HOUSE • SPRINGFIELD, ILLINOIS

ILLINOIS

THE STATE OF BALANCED ADVANTAGES

INDUSTRIAL CHEMICALS

	Current Price	Last Month	Last Year
Acetone, drums, lb	$0.07½–$0.08	$0.07½–$0.08	$0.07 –$0.07½
Acid, acetic, 28%, bbl., cwt	2.23 – 2.48	2.23 – 2.48	2.23 – 2.48
Glacial 99%, drums	8.43 – 8.68	8.43 – 8.68	8.43 – 8.68
U. S. P. reagent	10.25 –10.50	10.25 –10.50	10.25 –10.50
Boric, bbl., ton	106.00–111.00	106.00–111.00	106.00–111.00
Citric, kegs, lb	.20 – .23	.20 – .23	.20 – .23
Formic, cbys., lb	.10½– .11	.10½– .11	.10½– .11
Gallic, tech., bbl., lb	.90 – 1.00	.90 – 1.00	.70 – .75
Hydrofluoric 30% drums, lb	.08 – .08½	.08 – .08½	.07 – .07½
Lactic, 44%, tech., light, bbl., lb	.06½– .06½	.06½– .06½	.06½– .06½
Muriatic, 18°, tanks, cwt	1.05 –.....	1.05 –.....	1.05 –.....
Nitric, 36°, carboys, lb	.05 – .05½	.05 – .05½	.05 – .05½
Oleum, tanks, wks., ton	18.50 –20.00	18.50 –.....	18.50 –20.00
Oxalic, crystals, bbl., lb	.10½– .12	.10½– .12	.10½– .12
Phosphoric, tech., c'bys., lb	.07½– .08½	.07½– .08½	.07½– .08½
Sulphuric, 60°, tanks, ton	13.00 –.....	13.00 –.....	13.00 –.....
Sulphuric, 66°, tanks, ton	16.50 –.....	16.50 –.....	16.50 –.....
Tannic, tech., bbl., lb	.54 – .56	.54 – .56	.40 – .45
Tartaric, powd., bbl., lb	.43½–.....	.43½–.....	.31½–.....
Tungstic, bbl., lb	nom.	nom.	nom. .....
Alcohol, amyl	–.....	–.....	–.....
From Pentane, tanks, lb	.101–.....	.101–.....	.101–.....
Alcohol, Butyl, tanks, lb	.09 –.....	.09 –.....	.09 –.....
Alcohol, Ethyl, 190 p'f., bbl., gal	6.04 –.....	6.03–.....	4.54 –.....
Denatured, 190 proof	–.....	–.....	–.....
No. 1 special, bbl., gal. wks.	.31½–.....	.30½–.....	.29½–.....
Alum, ammonia, lump, bbl., lb	.03½– .04	.03½– .04	.03½– .04
Potash, lump, bbl., lb	.03½– .04	.03½– .04	.03½– .04
Aluminum sulphate, com. bags, cwt	1.15 – 1.40	1.15 – 1.40	1.15 – 1.40
Iron free, bg., cwt	1.60 – 1.70	1.60 – 1.70	1.30 – 1.55
Aqua ammonia, 26°, drums, lb	.02½– .03	.02½– .03	.02 – .03
tanks, lb	.02 – .02½	.02 – .02½	.02 – .02½
Ammonia, anhydrous, cyl., lb	.16 –.....	.16 –.....	.16 – .16
tanks, lb	.04½–.....	.04½–.....	.04½–.....
Ammonium carbonate, powd. tech., casks, lb	.09 – .12	.09 – .12	.09 – .12
Sulphate, wks., cwt	1.40 –.....	1.40 –.....	1.40 –.....
Amylacetate tech., from pentane, tanks, lb	.11½–.....	.11½–.....	.10½– .10½
Antimony Oxide, bbl., lb	.13 –.....	.13 –.....	.17 –.....
Arsenic, white, powd., bbl., lb	.03½– .04	.03½– .04	.03 – .03½
Red, powd., kegs, lb	.17 – .18	.17 – .18	.15½– .16
Barium carbonate, bbl., ton	52.50 –57.50	52.50 –57.50	52.50 –57.50
Chloride, bbl., ton	79.00 –81.00	79.00 –81.00	79.00 –81.00
Nitrate, casks, lb	.08½– .10	.08½– .10	.07 – .08
Blanc fixe, dry, bbl., lb	.03½– .04	.03½– .04	.03½– .04
Bleaching powder, f. o. b., wks., drums, cwt	2.00 – 2.10	2.00 – 2.10	2.00 – 2.10
Borax, gran., bags, ton	43.00 –.....	43.00 –.....	48.00 –51.00
Bromine, cs., lb	.30 – .32	.30 – .32	.30 – .32
Calcium acetate, bags	1.90 –.....	1.90 –.....	1.90 –.....
Arsenate, dr., lb	.06½– .06¾	.06½– .06¾	.06¾– .07
Carbide drums, lb	.04½– .05	.04½– .05	.05 – .06
Chloride, fused, dr., del., ton	19.00 –24.50	19.00 –24.50	21.50 –24.50
flake, dr., del., ton	20.50 –25.00	20.50 –25.00	23.00 –25.00
Phosphate, bbl., lb	.07½– .08	.07½– .08	.07½– .08
Carbon bisulphide, drums, lb	.05 – .06	.05 – .06	.05 – .06½
Tetrachloride drums, lb	.04½– .05½	.04½– .05½	.04½– .05½
Chlorine, liquid, tanks, wks., lb	1.75 –.....	1.75 –.....	1.75 –.....
Cylinders	.05½– .06	.05½– .06	.05½– .06
Cobalt oxide, cans, lb	1.84 – 1.87	1.84 – 1.87	1.84 – 1.87
Copperas, bgs., f. o. b., wks., ton	18.00 –19.00	18.00 –19.00	17.00 –18.00
Copper carbonate, bbl., lb	.10 – .16½	.10 – .16½	.10 – .16
Sulphate, bbl., cwt	4.75 – 5.00	4.75 – 5.00	4.75 – 5.00
Cream of tartar, bbl., lb	.36½–.....	.36½–.....	.25½–.....
Diethylene glycol, dr., lb	.22 – .23	.22 – .23	.22 – .23
Epsom salt, dom., tech., bbl., cwt	1.80 – 2.00	1.80 – 2.00	1.80 – 2.00
Ethyl acetate, drums, lb	.07½–.....	.07 –.....	.061–.....
Formaldehyde, 40%, bbl., lb	.05½– .06	.05½– .06½	.05½– .06½
Furfural, tanks, lb	.09 –.....	.09 –.....	.09 –.....
Fusel oil, ref. drums, lb	.16 – .17	.16 – .17	.16 – .17
Glaubers salt, bags, cwt	.95 – 1.00	.95 – 1.00	.95 – 1.00
Glycerine, c.p., drums, extra, lb	.12½–.....	.12½–.....	.12½–.....
Lead:			
White, basic carbonate, dry casks, lb	.07½–.....	.07½–.....	.07 –.....
White, basic sulphate, sck., lb	.07½–.....	.07 –.....	.06½–.....
Red, dry, sck., lb	.08 –.....	.08½–.....	.08 –.....
Lead acetate, white crys., bbl., lb	.11 – .12	.11 – .12	.11 – .12
Lead arsenate, powd., bag, lb	.09½– .11	.089– .11	.10 – .10½
Lime, chem., bulk, ton	8.50 –.....	8.50–.....	8.50 –.....
Litharge, pwd., csk., lb	.07 –.....	.07½	.07 –.....
Lithophone, bags, lb	.0385 .04	.036– .04	.04 – .04½
Magnesium carb., tech., bags, lb	.06½– .06¾	.06½– .06¾	.06 – .06½

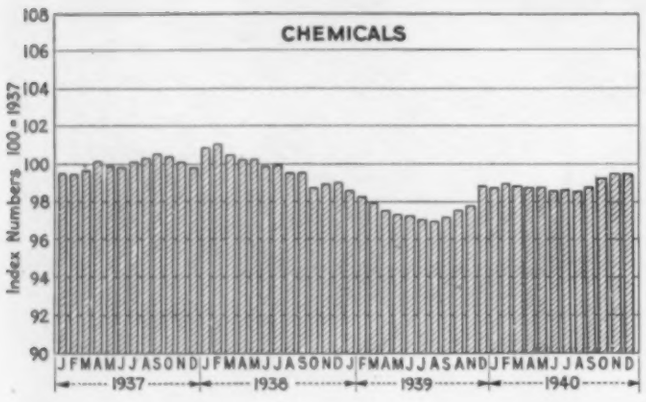
The accompanying prices refer to round lots in the New York market. Where it is the trade custom to sell f.o.b. works, quotations are given on that basis and are so designated. Prices are corrected to Dec. 12

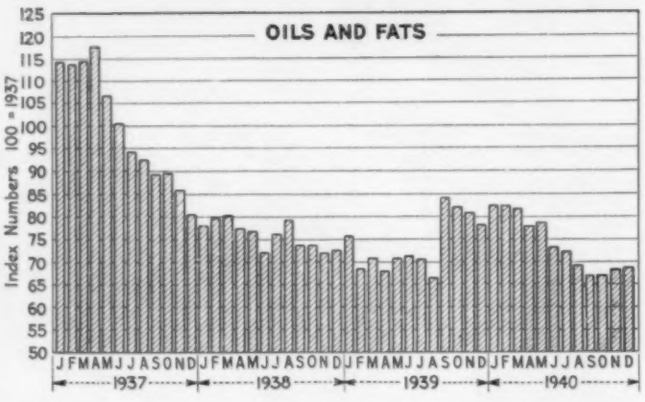
	Current Price	Last Month	Last Year
Methanol, 95%, tanks, gal	.29 –.....	.29 –.....	.31 –.....
97%, tanks, gal	.30 –.....	.30 –.....	.32 –.....
Synthetic, tanks, gal	.30 –.....	.30 –.....	.33 –.....
Nickel salt, double, bbl., lb	.13 – .13¼	.13 – .13¼	.13 – .13¼
Orange mineral, csk., lb	.11 –.....	.11½–.....	.10½–.....
Phosphorus, red, cases, lb	.40 – .42	.40 – .42	.40 – .42
Yellow, cases, lb	.18 – .25	.18 – .25	.18 – .25
Potassium bichromate, casks, lb	.08½– .09	.08½– .09	.08½– .09
Carbonate, 80–85%, calc. csk., lb	.06½– .07	.06½– .07	.06½– .07
Chlorate, powd., lb	.10 – .12	.10 – .12	nom. .....
Hydroxide(c'stic potash) dr., lb.	.07 – .07½	.07 – .07½	.07 – .07½
Muriate, 80% bgs., unit	.53½–.....	.53½–.....	.53½–.....
Nitrate, bbl., lb	.05½– .06	.05½– .06	.05½– .06
Permanganate, drums, lb	.18½– .19	.18½– .19	.18½– .19
Prussiate, yellow, casks, lb	.15 – .16	.15 – .16	.15 – .16
Sal ammoniac, white, casks, lb	.0515 .06	.05 – .06	.05 – .05½
Salsoda, bbl., cwt	1.00 – 1.05	1.00 – 1.05	1.00 – 1.05
Salt cake, bulk, ton	23.00 –.....	23.00 –.....	23.00 –.....
Soda ash, light, 58%, bags, contract, cwt	1.05 –.....	1.05 –.....	1.05 –.....
Dense, bags, cwt	1.10 –.....	1.10 –.....	1.10 –.....
Soda, caustic, 76%, solid, drums, cwt	2.30 – 3.00	2.30 – 3.00	2.30 – 3.00
Acetate, works, bbl., lb	.04 – .05	.04 – .05	.04 – .05
Bicarbonate, bbl., cwt	1.70 – 2.00	1.70 – 2.00	1.70 – 2.00
Bichromate, casks, lb	.06½– .07	.06½– .07	.06½– .07
Bisulphate, bulk, ton	16.00 –17.00	16.00 –17.00	15.00 –16.00
Bisulphite, bbl., lb	.03 – .04	.03 – .04	.03½– .04
Chlorate, kegs, lb	.06½– .06¾	.06½– .06¾	.06½– .06¾
Cyanide, cases, dom., lb	.14 – .15	.14 – .15	.14 – .15
Fluoride, bbl., lb	.07 – .08	.07 – .08	.07½– .08
Hyposulphite, bbl., cwt	2.40 – 2.50	2.40 – 2.50	2.40 – 2.50
Metasilicate, bbl., cwt	2.35 – 2.40	2.35 – 2.40	2.20 – 3.20
Nitrate, bulk, cwt	1.45 –.....	1.45 –.....	1.45 –.....
Nitrite, casks, lb	.06½– .07	.06½– .07	.06½– .07
Phosphate, tribasic, bags, lb	2.25 –.....	2.25 –.....	2.10 –.....
Prussiate, yel. drums, lb	.10½– .11	.10½– .11	.09½– .10
Silicate (40° dr.) wks., cwt	.80 – .85	.80 – .85	.80 – .85
Sulphide, fused, 60–62%, dr., lb.	.02½– .03½	.02½– .03	.02½– .03
Sulphite, crys., bbl., lb	.02½– .02¾	.02½– .02¾	.02½– .02¾
Sulphur, crude at mine, bulk, ton	16.00 –.....	16.00 –.....	16.00 –.....
Chloride, dr., lb	.03 – .04	.03 – .04	.03 – .04
Dioxide, cyl., lb	.07 – .08	.07 – .08	.07 – .07½
Flour, bag, cwt	1.60 – 3.00	1.60 – 3.00	1.60 – 3.00
Tin Oxide, bbl., lb	.54 –.....	.54 –.....	.52 –.....
Crystals, bbl., lb	.38 –.....	.38½–.....	.40 –.....
Zinc, chloride, gran., bbl., lb	.05 – .06	.05 – .06	.05 – .06
Carbonate, bbl., lb	.14 – .15	.14 – .15	.14 – .15
Cyanide, dr., lb	.33 – .35	.33 – .35	.33 – .35
Dust, bbl., lb	.09½–.....	.09½–.....	.08½–.....
Zinc oxide, lead free, bag., lb	.06½–.....	.06½–.....	.06½–.....
5% lead sulphate, bags, lb	.06½–.....	.06½–.....	.06½–.....
Sulphate, bbl., cwt	3.05 – 3.25	3.05 – 3.25	2.75 – 3.00

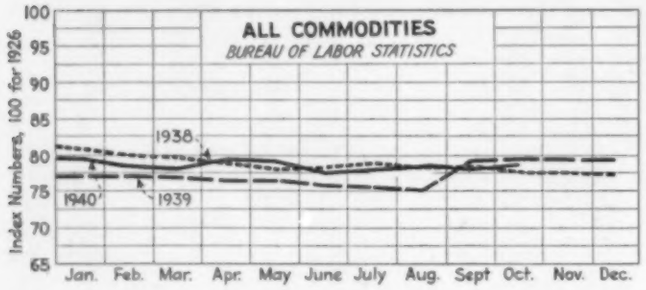
OILS AND FATS

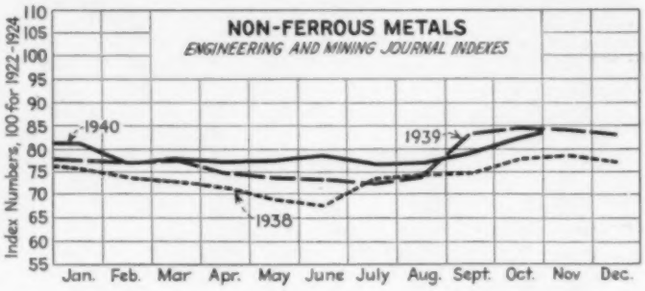
	Current Price	Last Month	Last Year
Castor oil, 3 bbl., lb	$0.10½–$0.11	$0.10½–$0.11	$0.11½–$0.12
Chinawood oil, bbl., lb	.26 –.....	.26 –.....	.26 –.....
Coconut oil, Ceylon, tank, N. Y., lb	.02½–.....	.02½–.....	.03½–.....
Corn oil crude, tanks (f. o. b. mill), lb	.05½–.....	.05½–.....	.05½–.....
Cottonseed oil, crude (f. o. b. mill), tanks, lb	.04½–.....	.04½–.....	.05½–.....
Linseed oil, raw car lots, bbl., lb	.087–.....	.087–.....	.097–.....
Palm, casks, lb	.03½–.....	.03½–.....	.05½–.....
Peanut oil, crude, tanks (mill), lb	.05½–.....	.05½–.....	.06½–.....
Rapeseed oil, refined, bbl., gal	1.10 –.....	1.10 –.....	.100–.....
Soya bean, tank, lb	.04½–.....	.04½–.....	.04½–.....
Sulphur (olive foots), bbl., lb	.10 –.....	.10 –.....	.10 –.....
Cod, Newfoundland, bbl., gal	nom.	nom.	nom. .....
Menhaden, light pressed, bbl., lb	.074–.....	.067–.....	.069–.....
Crude, tanks (f. o. b. factory), gal	.30 –.....	.21 –.....	.35 –.....
Grease, yellow, loose, lb	.04½–.....	.04½–.....	.05 –.....
Oleo stearine, lb	.06½–.....	.06½–.....	.08½–.....
Oleo oil, No. 1	.05½–.....	.05½–.....	.08 –.....
Red oil, distilled, d.p. bbl., lb	.06½–.....	.06½–.....	.09 –.....
Tallow extra, loose, lb	.04½–.....	.04½–.....	.05½–.....

Chem. & Met.'s Weighted Price Indexes









Coal-Tar Products

	Current Price	Last Month	Last Year
Alpha-napthol, crude bbl., lb.	$0.52 -$0.55	$0.52 -$0.55	$0.52 -$0.55
Alpha-naphthylamine, bbl., lb.	.32 - .34	.32 - .34	.32 - .34
Aniline oil, drums, extra, lb.	.15 - .16	.15 - .16	.15 - .16
Aniline, salts, bbl., lb.	.22 - .24	.22 - .24	.22 - .24
Benzaldehyde, U.S.P., dr., lb.	.85 - .95	.85 - .95	.85 - .95
Benzidine base, bbl., lb.	.70 - .75	.70 - .75	.70 - .75
Benzoic acid, U.S.P., kgs., lb.	.54 - .56	.54 - .56	.54 - .56
Benzyl chloride, tech., dr., lb.	.23 - .25	.23 - .25	.23 - .25
Benzol, 90%, tanks, works, gal.	.14 -.....	.15 - .18	.16 - .18
Beta-napthol, tech., drums, lb.	.23 - .24	.23 - .24	.23 - .24
Cresol, U.S.P., dr., lb.	.09½- .10	.09½- .10	.09½- .10
Cresylic acid, dr., wks., gal.	.58 - .60	.58 - .60	.58 - .60
Diethylaniline, dr., lb.	.40 - .45	.40 - .45	.40 - .45
Dinitrophenol, bbl., lb.	.23 - .25	.23 - .25	.23 - .25
Dinitrotoluol, bbl., lb.	.15½- .16	.15½- .16	.15 - .16
Dip oil, 15%, dr., gal.	.23 - .25	.23 - .25	.23 - .25
Diphenylamine, bbl., lb.	.25 - .27	.25 - .27	.32 - .36
H-acid, bbl., lb.	.45 - .50	.45 - .55	.50 - .55
Naphthalene, flake, bbl., lb.	.07 - .07½	.07 - .07½	.05½- .06
Nitrobenzene, dr., lb.	.08 - .09	.08 - .09	.08 - .09
Para-nitraniline, bbl., lb.	.47 - .49	.47 - .49	.47 - .49
Phenol, U.S.P., drums lb.	.12 -.....	.13 -.....	.13 -.....
Picric acid, bbl., lb.	.35 - .40	.35 - .40	.35 - .40
Pyridine, dr., gal.	1.70 - 1.80	1.70 - 1.80	1.55 - 1.60
Resorcinol, tech., kegs, lb.	.75 - .80	.75 - .80	.75 - .80
Salicylic acid, tech., bbl., lb.	.33 - .40	.33 - .40	.33 - .40
Solvent naptha, w.w., tanks, gal.	.27 -.....	.27 -.....	.26 -.....
Tolidine, bbl., lb.	.86 - .88	.86 - .88	.86 - .88
Toluol, drums, works, gal.	.30 -.....	.30 -.....	.27 -.....
Xylol, com, tanks, gal.	.26 -.....	.27 -.....	.26 -.....

Miscellaneous

	Current Price	Last Month	Last Year
Barytes, grd., white, bbl., ton.	$22.00-$25.00	$22.00-$25.00	$22.00-$25.00
Casein, tech., bbl., lb.	.13 - .14	.11½- .13	.17 - .22
China clay, dom., f.o.b. mine, ton.	8.00 -20.00	8.00 -20.00	8.00 -20.00
Dry colors			
Carbon gas, black (wks.), lb.	.028- .30	.028- .30	02½- .30
Prussian blue, bbl., lb.	.36 - .37	.36 - .37	.36 - .37
Ultramarine blue, bbl., lb.	.11 - .26	.11 - .26	.10 - .26
Chrome green, bbl., lb.	.21½- .30	.21½- .30	.21 - .27
Carmine red, tins, lb.	4.85 - 5.00	4.85 - 5.00	4.85 - 5.00
Para toner, lb.	.75 - .80	.75 - .80	.75 - .80
Vermilion, English, bbl., lb.	3.12 - 3.20	nom.....	2.70 - 2.90
Chrome yellow, C.P., bbl., lb.	.14½- .15½	.14½- .15½	.14½- .15½
Feldspar, No. 1 (f.o.b. N.C.), ton.	6.50 - 7.50	6.50 - 7.50	6.50 - 7.50
Graphite, Ceylon, lump, bbl., lb.	.06 - .06½	.06 - .06½	.06 - .06½
Gum copal Congo, bags, lb.	.08 - .30	.08 - .30	.06 - .30
Manila, bags, lb.	.09 - .15	.09 - .14	.09 - .14
Damar, Batavia, cases, lb.	.10 - .22	.10 - .20	.08 - .24
Kauri, cases, lb	.18 - .60	.18 - .60	.18½- .60
Kieselguhr (f.o.b. N.Y.), ton.	50.00 -55.00	50.00 -55.00	50.00 -55.00
Magnesite, calc, ton	50.00 -.....	50.00 -.....	50.00 -.....
Pumice stone, lump, bbl., lb.	.05 - .07	.05 - .08	.05 - .07
Imported, casks, lb.	.03 - .04	.03 - .04	.03 - .04
Rosin, H., 100 lb.	2.44 -.....	2.51 -.....	..... -.....
Turpentine, gal.	.43 -.....	.45 -.....	.32½-.....
Shellac, orange, fine, bags, lb.	.28 -.....	.26 -.....	.26 -.....
Bleached, bonedry, bags, lb.	.26 -.....	.24 -.....	.25 -.....
T. N. Bags, lb.	.17 -.....	.15 -.....	.20 -.....
Soapstone (f.o.b. Vt.), bags, ton.	10.00 -12.00	10.00 -12.00	10.00 -12.00
Talc, 200 mesh (f.o.b. Vt.), ton.	8.00 - 8.50	8.00 - 8.50	8.00 - 8.50
300 mesh (f.o.b. Ga.), ton.	7.50 -10.00	7.50 -10.00	7.50 -11.00
225 mesh (f.o.b. N.Y.), ton.	13.75 -.....	13.75 -.....	13.75 -.....

Industrial Notes

COPPERWELD STEEL CO., Warren, Ohio, has appointed Paul Keller as district manager of sales in Cleveland with headquarters in the Swetland Bldg.

MANNING, MAXWELL & MOORE, INC., Bridgeport, Conn., announces that Joseph W. Yowell has joined the organization in charge of aircraft instrument sales.

WORTHINGTON PUMP AND MACHINERY CORP., Harrison, N. J., has added Earl G. Morgan to its air conditioning and refrigeration division with headquarters at Kansas City, Mo.

THE BABCOCK & WILCOX TUBE CO., Beaver Falls, Pa., announces that the sale of its products in Argentina, Brazil, Paraguay, and Uruguay are handled by Babcock & Wilcox, Ltd., London, Eng.

ROBINSON MANUFACTURING CO., Muncy, Pa., has established a service and sales office in Philadelphia in the Commercial Trust Bldg., with R. V. Schneider in charge.

COLUMBIA ALKALI CORP., Barberton, Ohio, has opened a sales office at Durham, N. C. J. R. Simson is manager of the office which, after Feb. 1, will be located at Charlotte.

ALLIS-CHALMERS MFG. CO., Milwaukee, has appointed R. N. Miers eastern district engineer with headquarters in the Boston office.

AMERICAN CAR & FOUNDRY CO., New York, has placed Jay M. Reibel in charge of its advertising and that of its subsidiary companies.

BAKELITE CORP., Unit of Union Carbide and Carbon Corp., New York, has appointed Howard Smith manager of varnish-resin sales. Mr. Smith had been in charge of the Cleveland sales office since 1932.

AMPCO METAL, INC., Milwaukee, is completing a new two-story office building constructed with glass block walls.

AMERICAN CAN CO., New York, has advanced M. J. Sullivan to the position of executive vice-president. Mr. Sullivan formerly was vice-president in charge of the Pacific district.

AMERICAN CYANAMID CO., New York, has moved the office of its Calco chemical division from 90 West St. to the general offices at 30 Rockefeller Plaza.

HARSHAW CHEMICAL CORP., Cleveland, will build a chemical manufacturing plant at Elyria, Ohio, to cost $50,000.

Here is NEWS!!!

WITH the new lower prices, the use of Morpholine is more advantageous than ever for many applications. New and improved products which may have been awaiting lower costs can now be reconsidered. Morpholine is extremely useful for the following:

For Maintaining Constant Alkalinity — Dilute water solutions of Morpholine boil or evaporate with little change in composition. Therefore, during evaporation or simple distillation, an unusually constant concentration of Morpholine can be maintained both in the original solution and in the distillate. This results in uniform alkalinity.

Water-Resistant Polishes —Morpholine soaps offer numerous advantages in surface-coating emulsions. The moderate volatility of Morpholine causes it to remain in the emulsion during preparation, without boil-off loss. After application, however, the Morpholine evaporates gradually with the water from the drying emulsion film, leaving it resistant to subsequent water treatments . . . making it ideally suited for the formulation of floor polishes.

Insecticides — Because Morpholine volatilizes from the drying film and hence retards re-emulsification by water, its use in an emulsion-type spray helps the active material to adhere to the foliage and increases its resistance to rain. In addition, the decrease in alkalinity on drying reduces the chances of plant injury.

The Unique Ring structure of Morpholine accounts for its high solvent power for dyes, resins, waxes, hydrocarbons, casein, and shellac. No other commercial substance seems to be as compatible with such a wide variety of materials as Morpholine. It undergoes the usual reactions of a secondary amine and offers possibilities in the synthesis of dyes, inhibitors, rubber and photographic chemicals, and certain pharmaceuticals.

For information concerning the use of Morpholine, address:

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Unit of Union Carbide and Carbon Corporation

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30 East 42nd Street, New York, N. Y.

PRODUCERS OF SYNTHETIC ORGANIC CHEMICALS

Chem & Met New CONSTRUCTION

	Current Projects		Cumulative 1940	
	Proposed Work	Contracts	Proposed Work	Contracts
New England	$40,000	$94,000	$820,000	$1,717,000
Middle Atlantic	140,000	640,000	12,310,000	18,230,000
South	80,000	15,000,000	16,575,000	52,180,000
Middle West	3,100,000	1,295,000	21,395,000	7,775,000
West of Mississippi	500,000	160,000	28,170,000	35,343,000
Far West	.....	.....	4,990,000	4,398,000
Canada	350,000	.....	30,885,000	22,521,000
Total	$4,210,000	$17,189,000	$115,145,000	$142,159,000

PROPOSED WORK

Ill., Chicago—Marine Oil Terminal Co., 1725 West 31st St., plans to construct a petroleum storage plant, etc., on Cicero Ave. Estimated cost $250,000.

La., Eola—Anchor Gasoline Co., Eola, has acquired the holdings of the Mocklet Petroleum Corp., Brownwood, Tex., and plans to install Butane gasoline extraction plant. Estimated cost $80,000.

Ill., Roxana—Shell Oil Co., St. Louis, Mo., plans to construct a solvents plant at its refinery at Roxana. Estimated cost $500,000.

Mass., West Hanover—National Fireworks Co., Geo. J. J. Clark, Pres., is receiving bids for a 2 story, 36x96 ft., 30x48 ft. and 30x60 ft. addition to its plant. Whidden Co., 100 Arlington St., Boston, Engr. Estimated cost will exceed $40,000.

N. M., Gallup—Gallup Distilleries, Inc., Gallup, plan to construct a distilling plant. Estimated cost $150,000.

O., Akron—Goodyear Tire & Rubber Co., Akron, plans to construct a combined 1 and 2 story commercial factory for the manufacture of rubber—such as synthetic chemigum. Estimated cost will exceed $150,000.

O., Barberton—Pittsburgh Plate Glass Co., Barberton, and 632 Duquesne Way, Pittsburgh, Pa., plans to construct a limestone mine on a 600 acre tract between State Route 21 and Sherman Village, about 2 mi. west of Barberton to be the deepest in the world. Estimated cost $2,000,000.

O., Cleveland—Hinde & Dauch Paper Co., 407 Decatur St., Sandusky, is having plans prepared by its own engineering department for the construction of a 1 and 2 story, 150x300 ft. warehouse. Estimated cost $100,000.

O., Lancaster—Anchor Hocking Glass Corp., Lancaster, will receive bids in about 30 days for the construction of a warehouse and loading platform. Estimated cost will exceed $100,000.

Pa., Philadelphia—Linear Packing & Rubber Co., Inc., State Rd. and Levict St., plans to improve and construct an addition to its plant. Clarence E. Wunder, Architects Bldg., Archt. and Engr. Estimated cost including equipment will exceed $40,000.

Pa., Philadelphia—Molded Insulation Co., Price St., will soon award the contract for a 3 story, 52x175 ft. addition to its plant. J. W. Keyes, 142 South 16th St., Archt. and F. D. Shaw, 34 South 17th St., Engr. Estimated cost $100,000.

Tex., Agua Dulce—Davis & Co., Inc., c/o N. V. Hansell, 1312-40 Commerce St., Houston, plans to construct a new unit at its recycling plant in Jim Wells Co. Estimated cost $350,000.

N. S., Port Saxon—J. M. Carson Co., Ltd., Prince Rupert, B. C., Can., plans to construct an oil producing plant. Estimated cost $40,000.

Ont., London—Yocum Faust Co., St. George St., London, Ont., manufacturer of industrial chemicals, plans to reequip portion of its plant recently destroyed by fire, with a loss of $40,000.

Ont., Richmond Hill—Vitamin Oil Producers, Ltd., 300 Commonwealth Bldg., Toronto, has purchased a site here for the construction of a new plant.

Ont., Toronto—Lever Bros., Ltd., 290 Eastern Ave., is having plans prepared by Ewart, Armour & Byam, Engrs., Excelsior Bldg., for further extensions to its paint. Estimated cost $50,000.

Ont., Windsor—Socony-Vacuum Oil Co. of Canada, Ltd., c/o J. D. Watt, 56 Spark St., Ottawa, plans to construct a plant for producing petroleum and petroleum byproducts. Estimated cost $40,000.

Que., Montreal—Dominion Plastics, Ltd., c/o P. F. Vineberg, 107 Craig St., W., plans to construct a plant for the manufacture of synthetic resin and other synthetic plastics. Estimated cost $50,000.

Que., Montreal—Laurentian Veneer & Log Corp., Ltd., 132 St. James St., W., plans to construct a veneer manufacturing plant. Estimated cost $40,000.

Que., Montreal—Refinex Oil & Gas, Ltd., G. G. Hyde, 112 St. James St., W., plans to construct a producing and refining plant. Estimated cost $50,000.

CONTRACTS AWARDED

Conn., New Haven—Connecticut Coke Co., foot of Stiles St., has awarded the contract for nine 56x61 ft. Koppers Becker type coke ovens, 33 ft. high, to Koppers Co., Koppers Bldg., Pittsburgh, Pa. Estimated cost $94,000.

Del., Wilmington—Hercules Powder Co., Delaware Trust Bldg., has awarded the contract for an addition to its laboratory to John E. Healy & Sons, Tatnall St., Wilmington. Estimated cost $40,000.

Ind., Indianapolis—Citizens Gas & Coke Utility, 47 South Pennsylvania Ave., has awarded the contract for 41 Koppers Becker type under jet coke ovens, to Koppers Co., Koppers Bldg., Pittsburgh, Pa. Estimated cost $1,100,000.

Md., Cumberland—Celanese Corp. of America, 180 Madison Ave., New York, N. Y., has awarded the contract for a 3 story, 100x140 ft. warehouse here to George F. Hazelwood Co., Cumberland, at $210,000.

Mo., St. Louis—Monsanto Chemical Co., 1702 South Second St., has awarded the contract for an 8 story, 60x82 ft. factory at 8011 Idaho Ave., St. Louis, to William H. & Nelson Cunliff Co., 3320 Lindell Blvd., St. Louis. Estimated cost including equipment $80,000.

N. J., Bayonne—Baker Castor Oil Co., 35 Avenue A, has awarded the contract for general alterations and additions to plant to James Mitchell, Inc., 575 West Side Ave., Jersey City, N. J.

N. J., Deepwater Point—E. I. du Pont de Nemours & Co., Wilmington, Del., will construct an addition to its Neoprene plant here. Work will be done with own forces. Estimated cost will exceed $40,000.

N. Y., Norwich—Norwich Chemical Co. has awarded the contract for a 2 story, 75x85 ft. addition to its factory to A. K. Ferguson Co., 1650 Hanna Bldg., Cleveland, O. Estimated cost including equipment $40,000.

N. Y., Binghamton—Bradson Oil Co., 15 Alice St., has awarded the contract for the construction of a warehouse to Webster & Webster, Sherwood Ave. Estimated cost $40,000.

N. Y., Hudson—Universal Atlas Cement Co., 135 East 42nd St., New York, N. Y., has awarded the contract for a 2 story, 43x72 ft. laboratory and a 2 story, 60x200 ft. shop building, to Rust Engineering Co., Clark Bldg., Pittsburgh, Pa. Estimated cost $100,000.

O., Cincinnati—Ault & Wiborg, Dana Ave., has awarded the contract for a 3 story, 50x75 ft. laboratory to Fisher-DeVore Construction Co., 3629 Idlewild St. Estimated cost $45,000.

O., Cleveland—McGean Chemical Co., Republic Bldg., Cleveland, has awarded the contract for a 1 story, 50x150 ft. addition to its factory to Sam W. Emerson Co., 1836 Euclid Ave., Cleveland. Estimated cost $50,000

O., Elyria—Harshaw Chemical Co., 1943 East 97th St., Cleveland, has awarded the contract for an addition to its factory here to DeHamel Construction Co., Citizens Bldg., Cleveland. Estimated cost $40,000.

O., Newark—Owens-Corning Fiberglass Corp., Chase Ave. and Riverside Dr., has awarded the contract for a 184x340 ft. warehouse to W. J. Camlin Contracting Co., 68 Waldo St. Estimated cost $60,000.

Pa., Bridgeville—American Cyanamid & Chemical Corp., E. Lust, Plant Supt., Bridgeville, has awarded the contract for rebuilding its 1 story, 145x600 ft. chemical plant recently destroyed by an explosion to Martin & Nettrour Contracting Co., Diamond Bldg., Pittsburgh.

Pa., New Castle—Shenango Pottery Co., J. M. Smith, Sr., Pres., has awarded the contract for 2 circular tunnel kilns, 70 ft. in diameter, to Allied Engineering Co., 4150 East 56th St., Cleveland. Estimated cost $50,000.

Pa., Zelienople—Johns-Manville Corp., S. K. Cooper, Local Plant Mgr., will alter and revamp refractory and acoustical products factory here. George S. Smith, company assistant chief engineer., Manville, N. J., will be in charge of work which will be done by separate contracts.

Tex., Cayuga—B. Skeen & Associates, Tyler, will enlarge gasoline refinery in Long Lake field near Cayuga. Work will be done by day labor and subcontracts. Estimated cost $80,000.

W. Va., Morgantown—U. S. War Department, 20th and Constitution Ave., Washington, D. C., has awarded the contract for the design, construction and equipment of an ammonia plant for the manufacture of anhydrous ammonia, to E. I. du Pont de NeMours & Co., Wilmington, Del. Estimated cost $15,000,000.

A New Organic Chemical

2-AMINO-2-METHYL-1-PROPANOL

$CH_3C(CH_3)NH_2CH_2OH$

2-Amino-2-methyl-1-propanol is an interesting new organic chemical which is being produced commercially for the first time by Commercial Solvents. This aminohydroxy compound is an alkaline, colorless, water-miscible and somewhat viscous liquid with a mild ammoniacal odor. 2-Amino-2-methyl-1-propanol deserves careful investigation on the part of every industrial and research chemist—it may make possible major improvements in your present products or processes or lead to the development of entirely new products.

The higher fatty acid soaps of 2-Amino-2-methyl-1-propanol, which are practically odorless, are excellent emulsifying agents for oils, fats, waxes, and similar materials, and are therefore useful in the manufacture of textile and leather specialties, water-emulsion paints, and self-polishing waxes of exceptionally good water resistance.

2-Amino-2-methyl-1-propanol has a boiling point of 165° C. so that it is entirely satisfactory for use at the elevated temperatures ordinarily employed in the manufacture of wax emulsions. Another advantage of this compound is that substantially less is required than of the other commonly-used organic bases to produce fully satisfactory emulsions.

Write today for a sample and further information.

Properties of 2-Amino-2-methyl-1-propanol

Molecular weight: *89.1.*
Melting point: *25°C. to 26°C.*
Boiling point: *165°C. at 760 mm.*
Specific gravity: *0.934 at 20°C./20°C.*
pH at 20°C. of 0.1 M solution: *11.27.*
Vapor pressure at 20°C.: *approx. 1 mm.*
Flash point (open cup): *159°F.*
Index of refraction at 20°C.: *1.449.*

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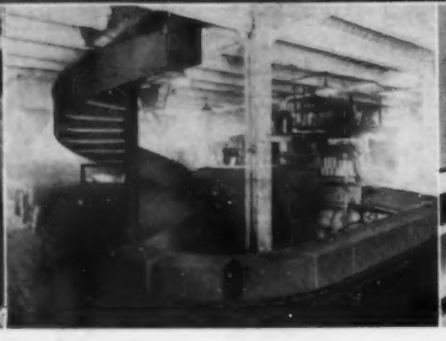

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Materials of Constr

PHYSICAL AND MECHANICAL PRO

No.	MATERIAL	MANUFACTURER	Essential Nominal Chemical Composition, Per Cent	Specific Gravity	Melting Point, °F.	Mean Coeff. Therm. Exp., 32-212° F. (Multiply by 10^{-6})	Therm. Conduc. C. G. S. Unit, Room Temp.	Form for which Tensile Prop. are Recorded	Tensile S 1,000 Lb.
	FERROUS ALLOYS								
1	Abrasion Resisting	Lukens Steel Co., Coatesville, Pa.	Fe; C, 0.4–0.5; Mn, 1.80 max.					Plates	110
2	Allegheny Metal 18-8	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 18–20; Ni, 8–10; C, 0.16 max.	7.9		0.95	0.04	Casting	70-
3	Allegheny Metal 18-8 S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 18–20; Ni, 8–10; C, 0.12 max.	7.9		0.95	0.04	Casting	70-
4	Allegheny Metal 18-8 S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 18–20; Ni, 8–10; C, 0.08 max.	7.9		0.95	0.04	Casting	70-
5	Allegheny Metal 20-10 S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 19–22; Ni, 10–12; C, 0.10 max.	7.9		0.95	0.04	Casting	68-
6	Allegheny Metal 25-12	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 22–26; Ni, 12–14; C, 0.18 max.	7.9		0.9	0.04	Casting	75-
7	Allegheny Metal 25-12 S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 22–26; Ni, 12–14; C, 0.11 max.	7.9		0.9	0.04	Casting	75-
8	Allegheny Metal 25-20	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 24–26; Ni, 19–21; C, 0.18 max.	7.9		0.9	0.04	Casting	60-
9	Allegheny Metal 25-20 S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 24–26; Ni, 19–21; C, 0.11 max.	7.9		0.9	0.04	Casting	60-
10	Allegheny Metal 20-25 S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 19–21; Ni, 24–26; C, 0.11 max.	7.9		0.9	0.04	Casting	60-
11	Allegheny Metal 20-25 SM	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 19–21; Ni, 24–26; C, 0.11 max.; Mo, 2–3	7.9		0.9	0.04	Casting	60-
12	Allegheny Metal 29-9	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 27–31; Ni, 8–10; C, 0.20 max.	7.9		0.9	0.04	Casting	80-
13	Allegheny Metal 29-9 S	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 27–31; Ni, 8–10; C, 0.12 max.	7.9		0.9	0.04	Casting	75-
14	Allegheny Metal 18-8 M	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 16–18; Ni, 14 max.; C, 0.16 max.; Mo, 2–3	7.9		0.95	0.04	Casting	73-
15	Allegheny Metal 18-8 SM	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 16–18; Ni, 14 max.; C, 0.12 max.; Mo, 2–3	7.9		0.95	0.04	Casting	73-
16	Allegheny Metal 19-10 M	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 18–20; Ni, 14 max.; C, 0.16 max.; Mo, 3–4	7.9		0.95	0.04	Casting	70-
17	Allegheny Metal 19-10 SM	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 18–20; Ni, 14 max.; C, 0.12 max.; Mo, 3–4	7.9		0.95	0.04	Casting	70-
18	Allegheny Metal 28-4	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 25–30; Ni, 3–5; C, 0.25 max.; N, 0.15	7.6		0.60	0.06	Casting	70-
19	Allegheny Metal 15-35	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 14–16; Ni, 33–36; C, 0.25 max.	7.9		0.8	0.04	Casting	50-
20	Allegheny Metal 18-8 C	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 17–20; Ni, 8–12; C, 0.10 max.; Cb, 8 x C	7.9		0.95	0.04	Casting	78-
21	Allegheny Metal 18-11 C	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 17–18.5; Ni, 10 min.; C, 0.08 max.; Cb, 8 x C	7.9		0.95	0.04	Casting	75-
22	Allegheny Metal 12 Chr.	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 10–13.5; Ni, 1 max.; C, 0.15	7.7		0.55	0.06	Casting	Depends
23	Allegheny Metal 17 Chr.	Allegheny Ludlum Steel Corp., Pittsburgh, Pa.	Fe; Cr, 14–18; Ni, 1 max.; C, 0.15 max.	7.7		0.60	0.06	Casting	Depends
24	Alray C	Alloy Metal Wire Co., Prospect Park, Pa.	Fe; Cr, 12; Ni, 62	8.20	2460		137	Annealed	95-
25	Alray D	Alloy Metal Wire Co., Prospect Park, Pa.	Fe; Cr, 35; Ni, 15	7.95	2550			Annealed	75-
26	Amsco F-1	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; Cr, 15–17; Ni, 34–36; C, 0.35 max.; Si, 1.5; Mn, 1	7.9–8.2	2550–2650	0.7	0.03		50-
27	Amsco F-3	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; Cr, 27–29; Ni, 3 max.; C [illegible] max.; Mn, 1 max.	7.5	2550–2630	1.0	0.059	As cast	40-
28	Amsco F-5	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; Cr, 17–19; Ni, 65–68; C, 0.50 max.; Si, 1.5; Mn, 1 max.	8.0	2550	0.9	0.035	As cast	50-
29	Amsco F-6	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; Cr, 12–14; Ni, 59–62; C, 0.50 max.; Si, 1.5; Mn, 1 max.		2500–2600				
30	Amsco F-8	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; Cr, 20–22; Ni, 8–10; C, 0.20 max.; Si, 1.5 max.; Mn, 1 max.	7.9	2460–2600	0.9	0.06	As cast	70-
31	Amsco F-10	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; Cr, 26–28; Ni, 10–12; C, 0.40 max.; Si, 1.5 max.; Mn, 1 max.	7.8–8.1	2460–2570	0.7–0.9	0.03–0.04	As cast	80-
32	Amsco Manganese Steel	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; C, 1.05–1.20; Mn, 12.5–13; Si, 0.4–0.6	7.81	2500–2600	1.8	0.027	Water quenched from 1850 deg. F.	120-
33	Amsco Ni-Mn Welding Rod	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; C, 0.75–0.95; Mn, 13–15; Ni, 3.5–4.5						
34	B & W 5150	Babcock & Wilcox Co., New York, N. Y.	Fe; Cr, 1.4; C, 1.0; Mn, 0.4; Si, 0.25						
35	Bethlehem 235	Bethlehem Steel Co., Bethlehem, Pa.	Fe; C, 0.35–0.50; Mn, 1.20–1.75; Si, 0.15–0.25						
36	Bethlehem 380	Bethlehem Steel Co., Bethlehem, Pa.	Fe; C, 0.75–0.85; Mn, 0.7–0.9; Si, 0.15–0.25						
37	Buffalonast Gray Iron	Buffalo Fdry. & Machine Co., Buffalo, N. Y.	Fe; C, 3.2–3.6; Ni, 2 max.; Si, 1–2; Mn, 0.6–0.9		2000–2800	0.86		Bar	30-
38	Calmar 18-8	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 17–20; Ni, 7–10; C, as specified					Annealed casting	80-
39	Calmar 18-8 Cb	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 17–20; Ni, 7–10; C, as specified; Cb, 0.9–1.25					Annealed casting	80-
40	Calmar 18-8 M	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 17–20; Ni, 7–10; C, as specified; Mo, 2.5–4					Annealed casting	85-
41	Calmo 18	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 16–20; C, as specified					Cast, heat treated	65-
43	Calmo 15-35	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 14–17; Ni, 33–37; C, as specified.						55-
43	Calmo 25-12	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 24–27; Ni, 12–14; C, as specified					Annealed casting	75-
44	Calmo 25-20	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 23–27; Ni, 17–21; C, as specified		2550–2685			Annealed casting	72-
45	Calmo 28-10	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 27–30; Ni, 8–12; C, as specified						

struction for Chemical Engin

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PROPERTIES — CORROSION, HEAT

...ich ...are ...]	Tensile Strength, 1,000 Lb. per in.²	Yield Point, 1,000 Lb. per in.²	Elongation, % in 2 in.	Reduc. of Area, %	Elastic Modulus, Lb. per in.² (Multiply by 10^6)	Brinnell Hardness	Machining Qualities	Methods of Fabrication *	Forms Available *	Sulphuric Acid						Hydrochloric Acid			
										Temp.	0.5%	2.5%	10%	25%	60%	95%	Temp.	0.25%	1%	5
	110	60	20	40		225	Fair	R	HR, P										
	70–87	36–46	50–75	45–60	28–30			R, W	C										
	70–87	36–46	50–75	45–60	28–30			R, W	C										
	70–85	35–46	50–75	45–65	28–30			R, W	C	Room Boiling	R R	R				R			
	68–80	40–60	50–75	45–65	28–30			R, W	C	Room Boiling	R R	R				R			
	75–90	40–60	25–40	25–45	28–30			R, W	C										
	75–90	40–55	30–50	30–50	28–30			R, W	C	Room Boiling	R R	R				R			
	60–75	40–55	40–60	40–60	28–30			R, W	C	Room Boiling	R R	R				R			
	60–75	40–55	40–60	40–60	28–30			R, W	C										
	60–75	40–55	40–60	40–60	28–30			R, W	C										
	60–75	50–70	40–60	40–60	28–30			R, W	C										
	80–95	45–70	20–30	20–35	28–30			R, W	C										
	75–95	36–46	20–40	20–45	28–30			R, W	C										
	73–85	35–46	45–60	45–60	28–30			R, W	C										
	73–85	35–45	45–60	45–60	28–30			R, W	C										
	70–80	35–45	45–60	45–60	28–30			R, W	C	Room Boiling	R R	R		R	R	R			
	70–80	40–60	45–60	45–65	28–30			R, W	C										
	70–90	35–50	10–25	10–25	28–30			R, W	C										
	50–75	40–56	40–60	40–60	28–30			R, W	C										
	78–90	40–55	35–50	40–50	28–30			R, W	C	Room Boiling	R	R				R			
	75–90		35–50	40–50	28–30			R, W	C										
	Depends on heat treatment				28–30			R, W	C										
	Depends on heat treatment				28–30			R, W	C	Room Boiling						R			
	95–175	35	35–40	60				W, B	CR, D, R, W	Room Boiling	R R	R R	R				Room Boiling	R R	R R	R
	75–160		35–40	60				R, W, B		Room Boiling	R R	R					Room Boiling	R R	R R	R
	50–70	40–50	4–8	4–8	26	150–180	Fair	W	C										
	40–60	30–45	0–2			170	Fair	W	C										
	50–70	35–45	24–40			180–200	Fair	W	C										
								W	C										
	70–90	25–45	40–70	45–75	29	150–180	Good	W	C										
	80–100	40–55	30–50	30–50	23.5	160–190	Fair	W	C										
ed from	120–140	50–60	25–35	25–35		185–200		R, W											
									Welding wire										
						450–750													
							Fair												
							Fair			Primarily an abrasion resistant alloy									
	30–50					150–250	Good		C										
;	80–90	38–45	55–65				Fair		C										
;	80–85	40–45	40–45				Fair		C										
;	85–95	40–50	25–30			150	Fair		C										
d	65–75	45–52	20–25	35–40			Fair		C										
	55–65	35–40	10–15				Good		C										
;	75–85	40–45	30–35						C										
;	72–80	35–42	35–40			135–145	Fair		C										

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TIES

CORROSION, HEAT AND AB

Point, lb. per in.²	Elongation, % in 2 in.	Reduc. of Area, %	Elastic Modulus, Lb. per in.² (Multiply by 10^6)	Brinnell Hardness	Machining Qualities	Methods of Fabrication *	Forms Available *	Sulphuric Acid						Hydrochloric Acid						
								Temp.	0.5%	2.5%	10%	25%	60%	95%	Temp.	0.25%	1%	5%	20%	Conc.	Temp.
60	20	40		225	Fair	R	HR, P													
0-46	50-75	45-60	28-30			R, W	C													Room Boiling
5-46	50-75	45-60	28-30			R, W	C													
5-46	50-75	45-65	28-30			R, W	C	Room Boiling	R	R				R						Room Boiling
0-60	50-75	45-65	28-30			R, W	C	Room Boiling	R	R				R						Room Boiling
0-60	25-40	25-45	28-30			R, W	C													Room Boiling
0-55	30-50	30-50	28-30			R, W	C	Room Boiling	R	R				R						Room Boiling
0-55	40-60	40-60	28-30			R, W	C	Room Boiling	R	R				R						Room Boiling
0-55	40-60	40-60	28-30			R, W	C													
0-55	40-60	40-60	28-30			R, W	C													
0-70	40-60	40-60	28-30			R, W	C													
5-70	20-30	30-35	28-30			R, W	C													Room Boiling
6-46	20-40	20-45	28-30			R, W	C													
5-46	45-60	45-60	28-30			R, W	C													
5-45	45-60	45-60	28-30			R, W	C													
5-45	45-60	45-60	28-30			R, W	C	Room Boiling	R R	R		R	R	R						Room Boiling
0-60	45-60	45-65	28-30			R, W	C													
5-50	10-25	10-25	28-30			R, W	C													Room Boiling
0-56	40-60	40-60	28-30			R, W	C													
0-55	35-50	40-50	28-30			R, W	C	Room Boiling	R	R				R						Room Boiling
	35-50	40-50	28-30			R, W	C													
t			28-30			R, W	C													
8			28-30			R, W	C	Room Boiling						R						Room Boiling
35	35-40	60				W, B	CR, D, R, W	Room Boiling	R R	R R	R				Room Boiling	R R	R R	R	R	R	Room Boiling
	35-40	60				R, W, B		Room Boiling	R R	R					Room Boiling	R R	R R	R			Room Boiling
40-50	4-8	4-8	26	150-180	Fair	W	C													
0-45	0-2			170	Fair	W	C													
5-45	24-40			180-200	Fair	W	C													
						W	C													
5-45	40-70	45-75	29	150-180	Good	W	C													
0-55	30-50	30-50	23.5	160-190	Fair	W	C													
0-60	25-35	25-35		185-200		R, W														
							Welding wire													
				450-750																
					Fair															
					Fair			Primarily an abrasion resistant alloy												
				150-250	Good		C													
8-45	35-65				Fair		C													
0-45	40-45				Fair		C													
0-50	25-30			150	Fair		C													
5-52	20-25	35-40			Fair		C													
5-40	10-15				Good		C													
0-45	30-35						C													
5-42	35-40			135-145	Fair		C													

Composition—"Essentia
refers to the principa
proportion present. W
age it may be assum
the composition.
Forms Available—B =
D = drawn; HR =
S = sheets; T = tub
Methods of Fabrication
F = flanging; R =

41	Calorz 18	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 16-20; C, as specified				Cast, heat treated	65-7

ering Equipment

ND ABRASION RESISTANCE

	Nitric Acid				Acetic Acid					Phosphoric Acid				Sodium Hydroxide				Sodium Hypochlorite		Resistance		No.
	Temp.	0.5%	5%	20%	65%	Temp.	0.5%	10%	80%	100%	Temp.	10%	50%	85%	Temp.	0.5%	50%	70%	Temp.	5% free Cl	20% free Cl	Heat	Abrasion	
																						Fair	Good	1
	Room Boiling	R R	R R	R R	R R	Room Boiling	R	R	R	R														2
																								3
	Room Boiling	R R	R R	R R	R R	Room Boiling	R R	R R	R R	R R														4
	Room Boiling	R R	R R	R R	R R	Room Boiling	R	R	R	R														5
	Room Boiling	R R	R R	R R	R R	Room Boiling	R	R	R	R														6
	Room Boiling	R R	R R	R R	R R	Room Boiling	R	R	R	R														7
	Room Boiling	R R	R R	R R	R R	Room Boiling	R	R	R	R														8
																								9
																								10
																								11
	Room Boiling	R R	R R	R R	R R	Room Boiling	R	R																12
																								13
																								14
																								15
	Room Boiling	R R	R R	R R	R R	Room Boiling	R R	R R	R R	R R														16
																								17
	Room Boiling	R R	R R	R R	R R	Room Boiling	R	R	R	R														18
																								19
	Room Boiling	R R	R R	R R	R R	Room Boiling	R R	R R																20
																								21
																								22
	Room Boiling	R R	R R	R R	R R	Room Boiling	R	R																23
R	Room Boiling	R R	R R	R R	R R	Room Boiling	R R	R R	R R	R R	Room Boiling	R	R	R	Room Boiling	R R	R R	R R	Room Boiling	R	R			24
	Room Boiling	R R	R R	R R	R R	Room Boiling	R R	R R	R R	R R	Room Boiling	R R	R R	R R	Room Boiling	R R	R R	R R	Room Boiling	R		Good		25
																						Good		26
																						Good		27
																						Good		28
																						Good		29
																						Good		30
																						Good		31
																						Poor	Good	32
																						Poor	Good	33
																							Good	34
																							Good	35
																							Good	36
																							Good	37
																							Good	38
																							Good	39
																								40
																							Fair	41
																							Good	42
																								43
																							Fair	44

Acknowledgment of Source

At the repeated demand of its readers for concrete information on the resistance to corrosion, heat and abrasion of the various materials available for the construction of chemical engineering equipment, *Chem. & Met.* has, with the cooperation of manufacturers, compiled this tabulation of the properties of the metals and alloys.

All information on mechanical, physical and chemical properties as well as indication of reasonably good resistance to corrosion are made on the authority of the manufacturers to whom questionnaires were submitted.

Corrosion Data—The generally accepted unit of "inches penetration per year" has been used by the manufacturers in reporting results of corrosion tests. Conditions of temperature and concentration were outlined in the questionnaire and except where otherwise specified, it is understood the tests were not aerated. But since no standard test procedure is universally used the data are not always comparable. Therefore, as indicated in the note of caution elsewhere on this chart, the laboratory results should be used only to indicate whether or not service tests or trial installations are advisable. In no case should they be used to calculate a depreciation rate or otherwise estimate the exact life of a metal or alloy in actual service. Complete information regarding methods of testing and the bases for a decision of suitability can usually be obtained from the manufacturer on request.

Explanation of Terms

sition—"Essential nominal chemical composition" to the principal constituents and the approximate tion present. When "Fe" is shown without percent- may be assumed that it represents the balance of mposition.

Available—B = bar; C = casting; CR = cold rolled; drawn; HR = hot rolled; P = plates; R = rods; heets; T = tubes; W = wire.

ds of Fabrication—B = brazing; DD = deep drawing; flanging; R = riveting; W = welding.

Corrosion Data—R indicates that the metal or alloy should give reasonably good resistance under the conditions of concentration and temperature specified, but it does not imply any guarantee of satisfactory service. The figures following the R are the reported result of laboratory corrosion test in inches penetration per year. Where space is left blank either there are insufficient data available to indicate the extent of resistance or more complete information concerning the service required is necessary.

Footnotes—Superior numbers refer to footnotes.

	65-75	45-52	20-25	35-40			Fair		C

30-45	30-35						C				
35-42	25-40			135-145	Fair		C				
41	**Calcro 18**	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 16–20; C, as specified					Cast, heat treated	65-
42	**Calcro 15-35**	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 14–17; Ni, 33–37; C, as specified.						55-
43	**Calcro 25-12**	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 24–27; Ni, 12–14; C, as specified					Annealed casting	75-
44	**Calcro 25-20**	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 23–27; Ni, 17–21; C, as specified		2550–2685			Annealed casting	72-
45	**Calcro 28-10**	Warman Steel Casting Co., Huntington Pk., Calif.	Fe; Cr, 27–30; Ni, 8–12; C, as specified					Annealed casting	70-
46	**Carbon-Molybdenum Steel**	Lukens Steel Co., Coatesville, Pa.	Fe; C, 0.18–0.28; Mo, 0.4–0.6; Mn, 0.5–0.9					Plates	65-
47	**Casual Metal**	Lunkenheimer Co., Cincinnati, Ohio	Fe; Ni, 18–22; C, 2.2–2.8; Cu, 3.5–5.5; Cr, 1.4–1.9; Mn, 0.9–1.5	7.5–7.6	2175–2300				32
48	**Chromax**	Driver Harris Co., Harrison, N. J.	Fe; Cr, 15; Ni, 35	7.8	2450	0.70	0.036	Casting	60
49	**Chromax**	Driver Harris Co., Harrison, N. J.	Fe; Cr, 19; Ni, 35	7.9	2520	0.75	0.031	Wrought	70-
50	**Chromel C**	Hoskins Mfg. Co., Detroit, Mich.	Fe; Cr, 16; Ni, 61; C, 0.10	8.24	2460				105
51	**4-6 Chrome**	Spang Chalfant Division, Pittsburgh, Pa.	Fe; Cr, 4–6; C, 0.10 max.; Mn, 0.5 max.; Ti, 4–6 x C					Drawn	66
52	**4-6 Chrome**	Spang Chalfant Division, Pittsburgh, Pa.	Fe; Cr, 4–6; C, 0.20 max.; Mn, 0.5 max.			0.63		Annealed	67
53	**Chrome-Copper-Nickel Steel**	Lukens Steel Co., Coatesville, Pa.	Fe; Cr, 0.65–0.85; Ni, 0.75 max.; C, 0.12 max.; Cu, 0.45–0.65						65
54	**Chrome-Manganese Steel**	Lukens Steel Co., Coatesville, Pa.	Fe; Cr, 0.50; Mn, 0.90; C, 0.40					Plate	100
55	**Cimet**	Driver Harris Co., Harrison, N. J.	Fe; Cr, 23–28; Ni, 10–13	8.0	2550	0.89	0.04	Casting	65
56	**Circle L 1**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; C, 0.30; Mn, 1.35; Va., 0.10					Cast, normalized and drawn	90
57	**Circle L 2**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 0.75; C, 0.30; Mn, 1.35; Mo, 0.35					Cast, oil quenched and drawn	125
58	**Circle L 3**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 1.0; C, 0.45; Mo, 0.40					Cast, oil quenched and drawn	160
59	**Circle L 5**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 0.8; C, 0.30; Ni, 2; Mo, 0.35			0.64		Cast, normalized and drawn	100
60	**Circle L 10**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 4–6; C, 0.20; Mo, 0.50			0.62	0.10	Cast, normalized and drawn	100
61	**Circle L 11**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 18; C, 0.25					Cast, normalized and drawn	100
62	**Circle L 12**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 11.5–13; C, 0.12 max.	7.75		0.61	0.06	Cast, normalized and drawn	85
63	**Circle L 13**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 12–14; C, 0.30	7.8				Cast, oil quenched and drawn	200
64	**Circle L 19**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Ni, 2.75; C, 0.18					Cast, normalized and drawn	70
65	**Circle L 21**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 18–20; Ni, 8–10; C, 0.07 max.; Cb, 10 x C	7.8		0.89	0.063	Cast, water quenched	70
66	**Circle L 22**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 18–20; Ni, 8–10; C, 0.07 max.	7.8		0.89	0.063	Cast, water quenched	70
67	**Circle L 22 XM**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 18–20; Ni, 8–11; C, 0.07 max.; Mo, 2–4	7.8		0.89	0.063	Cast, water quenched	75
68	**Circle L 23**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 18–20; Ni, 8–10; C, 0.20 max.	7.8		0.89	0.063	Cast, water quenched	75
69	**Circle L 30**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 24; Ni, 12; C, 0.25	7.85		0.85	0.030	Cast, water quenched	80
70	**Circle L 31**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 28; Ni, 11; C, 0.30	7.9		0.78	0.025	Cast, water quenched	90
71	**Circle L 34**	Lebanon Steel Fdry., Lebanon, Pa.	Fe; Cr, 20; Ni, 30; C, 0.07 max.; Mo, 3; Cu, 5	7.9		0.80	0.05	Cast, water quenched	65
72	**Colonial 610**	Vanadium-Alloys Steel Co., Latrobe, Pa.	Fe; Cr, ~18; Ni, 1; C, 1.12 max.; S, optional; Mn, .25–.4	7.70	2500–2700	0.65	0.058	Annealed	85
73	**Cooper 14**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 11–14; C, 0.12–0.35	7.65	2750–2790	0.57	0.06	Annealed cast bar	75
74	**Cooper 16**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 14–18; C, 0.12–0.35	7.71	2710–2750	0.64	0.06	Annealed cast bar	75
75	**Cooper 17**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 17.5–19; Ni, 8–10; C, 0.08–0.20	7.85	2650–2700	0.89	0.069	Annealed cast bar	80
76	**Cooper 17 S**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 18–20; Ni, 8–10; C, 0.08 max.	7.85	2650–2700	0.89	0.069	Annealed cast bar	80
77	**Cooper 17 S Mo**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 16–20; Ni, 14 max.; C, 0.10 max.; Mo, 2–4	7.85	2650–2700	0.89	0.06	Annealed cast bar	85
78	**Cooper 17 S CB**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 18–20; Ni, 8–10; C, 0.08 max.; Cb, 10 x C	7.85	2650–2700	0.89	0.069	Annealed cast bar	80
79	**Cooper 18**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 10; Ni, 22; C, 0.20; Mn, 0.50	8.0	2675	1.0	0.074	Annealed cast bar	79
80	**Cooper 19 A**	Cooper Alloy Fdry Co., Elizabeth, N. J.	Fe; Cr, 26–30; Ni, 2–3; C, 0.20–0.50; Mn, 0.50	7.6	2675	0.56	0.064	As cast bar	70
81	**Cooper 19**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 26–30; C, 0.20–0.50; Mn, 0.50	7.6	2675	0.56	0.064	As cast bar	60
82	**Cooper 20**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 15–18; Ni, 35–38; C, 0.2–0.5; Mn, 0.50	7.95	2700	0.75	0.028	As cast bar	65
83	**Cooper 21**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 15; Ni, 65; C, 0.50 max.; Mn, 0.50	8.20	2500	0.76	0.033	Cast bar	60
84	**Cooper 21 A-B-C**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 15–20; Ni, 20–25; C, 0.07–0.10; Mo, 3; Si, 1.5	7.9	2700	0.85	0.055	Cast bar	70
85	**Cooper 22**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 24–28; Ni, 10–12; C, 0.20–0.50	7.90	2675	0.90	0.035	Cast bar	90
86	**Cooper 22 P-M**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 29; Ni, 9; C, 0.2–0.5; Mo, 3	7.90	2675	0.90	0.035	Cast bar	90
87	**Cooper KNC 3**	Cooper Alloy Fdry. Co., Elizabeth, N. J.	Fe; Cr, 24–26; Ni, 19–21; C, 0.25 max.	7.85	2700	0.95	0.03	Cast bar	65
88	**Corrosiron**	Pacific Foundry Co., San Francisco, Calif.	Fe; C, 0.8–1.0; Si, 14.50; Mn, 0.50	7.02	2400			Casting	16
89	**Crane 18-8 Mo**	Crane Co., Chicago, Ill.	Fe; Cr, 18–20; Ni, 9–10, C, 0.10; Mo, 2–4	8.02	2606–2679	0.96	0.069	Annealed cast bar	85
90	**Crane 5 Cr-Mo Cast Steel**	Crane Co., Chicago, Ill.	Fe; Cr, 4–6; C, 0.30 max.; Mo, 0.55					Cast, heat treated bar	110
91	**Croloy 2**	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 2; C, 0.15 max.; Mo, 0.50	7.70	2750	0.745		Annealed seamless tube	60 mi
92	**Croloy 3**	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 4–6; C, 0.15 max.; Mo, 0.45–0.65	7.7	2700	0.64		Seamless	60 mi
93	**Croloy 9**	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 8–10; C, 0.15 max.; Mo, 1.2–1.5	7.80	2725	0.63		Seamless tubing	60 mi
94	**Croloy 12**	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 12–14; C, 0.15 max.; Ni, 0.50 max.	7.72	2750–2790	0.61	0.0595	Seamless tubing	65-7
95	**Croloy 16-13-3**	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 17; Ni, 13; C, 0.10 max.; Mo, 2.75	8.02	2550	0.96	0.038	Seamless tubing	75 mi
96	**Croloy 18**	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 15–18; Ni, 0.50 max.; C, 0.12 max.	7.56	2710–2750	0.60	0.0582	Seamless tubing	70-
52	20–25	35–40			Fair		C		

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92	Croloy 5	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 4-6; C, 0.15 max.; Mo, 0.45-0.65							
93	Croloy 9	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 8-10; C, 0.15 max.; Mo, 1.2-1.5	7.80	2725	0.63		Seamless tubing	60 mi	
94	Croloy 12	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 12-14; C, 0.15 max.; Ni, 0.50 max.	7.72	2750-2790	0.61	0.0595	Seamless tubing	65-7	
95	Croloy 16-13-3	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 17; Ni, 13; C, 0.10 max.; Mo, 2.75	8.02	2550	0.96	0.038	Seamless tubing	75 mi	
96	Croloy 18	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 15-18; Ni, 0.50 max.; C, 0.12 max.	7.56	2710-2750	0.60	0.0582	Seamless tubing	70-8	
97	Croloy 18-8	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 18; Ni, 9.5; C, 0.07 max.; Mn, 0.75 max.	7.92	2550-2600	0.92	0.039	Seamless tubing	75 mi	
98	Croloy 25-20	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 25; Ni, 20; C, 0.10 max.	7.96	2500-2600	0.92	0.039	Seamless tubing	75 mi	
99	Croloy 27	Babcock & Wilcox Tube Co., Beaver Falls, Pa.	Fe; Cr, 27; Ni, 1 max.; C, 0.20 max.; N, 0.12-0.25	7.47	2700	0.59	0.05	Seamless tubing	75-9	
100	Duplex	Sowers Manufacturing Co., Buffalo, N. Y.	Fe; Cr, 2.35; Ni, 18.50; C, 2.85; Mn, 1	7.49				Cast	35	
101	Duraloy 18-8 S	Duraloy Co., Scottdale, Pa.	Fe; Cr, 17-19; Ni, 7-9; C, 0.07 max.; Mn, 1					Heat treated casting	65	
102	Duraloy 18-8 S Mo	Duraloy Co., Scottdale, Pa.	Fe; Cr, 17-19; Ni, 7-9; C, 0.07 max.; Mo, 2-4; Mn, 1					Heat treated casting	65	
103	Duraloy 35-15	Duraloy Co., Scottdale, Pa.	Fe; Cr, 14-16; Ni, 34-36; C, 0.50			0.75		As cast	60	
104	Duraloy 25-20 Mo	Duraloy Co., Scottdale, Pa.	Fe; Cr, 24-26; Ni, 19-21; C, 0.20; Mo, 2-3					Heat treated casting	65	
105	Duraloy A	Duraloy Co., Scottdale, Pa.	Fe; Cr, 27-30; C, 0.25 max.; Mn, 1	7.6				Casting	50	
106	Duraloy B	Duraloy Co., Scottdale, Pa.	Fe; Cr, 16-18; C, 0.20 max.; Mn, 1	7.7				Casting	90	
107	Duraloy N	Duraloy Co., Scottdale, Pa.	Fe; Cr, 23-25; Ni, 11-13; C, 0.35; Mn, 1	7.86				As cast	80	
108	Duraloy NS Mo	Duraloy Co., Scottdale, Pa.	Fe; Cr, 23-25; Ni, 11-13; C, 0.15 max.; Mo, 2-3					Heat treated casting	75	
109	Durco D-18	Duriron Co., Dayton, Ohio	Fe; Cr, 17-21; C, 0.20	7.6	2700			Sand casting	90	
110	Durco KA 2S	Duriron Co., Dayton, Ohio	Fe; Cr, 18-20; Ni, 8-10; C, 0.07 max.	7.80	2650	0.9	0.05	Sand casting	80-9	
111	Durco KA2S Mo	Duriron Co., Dayton, Ohio	Fe; Cr, 18-20; Ni, 8-10; C, 0.07 max.; Mo, 2-4	7.84	2650	0.9	0.05	Sand casting	85-9	
112	Durichlor	Duriron Co., Dayton, Ohio	Fe; C, 0.85; Si, 14.5; Mo, 3; Mn, 0.35	7.04	2350	0.36	0.125	Bar	17	
113	Durimet	Duriron Co., Dayton, Ohio	Fe; Cr, 19; Ni, 22; C, 0.07 max.; Mo, 3.5; Cu, 1	7.85	2650	0.78	0.05	Sand casting	65-7	
114	Duriron	Duriron Co., Dayton, Ohio	Fe; C, 0.80; Si, 14.50; Mn, 0.35	7.0	2300	0.36	0.125	Bar	16-1	
115	Economet	General Alloys Co., So. Boston, Mass.	Fe; Cr, 10; Ni, 30; C, ± .60; Mn, 1	7.70	2680-2780			Casting	60	
116	Economy Hardface-Self Hardening	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; C; Cr; Mo; Mn		2600-2800					
117	Elverite A	Babcock & Wilcox Co., New York, N. Y.	Fe; C, 3.00-3.5; Mn, 0.35; Si, 0.25-1.0							
118	Elverite B	Babcock & Wilcox Co., New York, N. Y.	Fe; Cr, 1-1.8; Ni, 3.75-4.75; C, 3-3.5; Si, 0.25-1							
119	Elverite C	Babcock & Wilcox Co., New York, N. Y.	Fe; Cr, 1-1.8; C, 3-3.5; Si, 0.25-1; Ni, 3.75-4.75							
120	Empire 8	Empire Steel Castings, Reading, Pa.	Fe; Cr, 1-1.25; C, 0.30-0.35; Mo, 0.25-0.3; Mn, .6-8					Annealed casting	105	
121	Empire 11	Empire Steel Castings, Reading, Pa.	Fe; Cr, 1-1.25; Ni, 2.25-2.75; C, 0.25-0.3; Mo, .3-.35					Annealed casting	105	
122	Empire 12	Empire Steel Castings, Reading, Pa.	Fe; Cr, 4.5-6.0; C, 0.20-0.30; Mn, 0.40-0.70					Annealed casting	85	
123	Empire 14	Empire Steel Castings, Reading, Pa.	Fe; Cr, 12-14; C, 0.15-0.25; Mn, 0.40-0.70					Annealed casting	95	
124	Empire 15	Empire Steel Castings, Reading, Pa.	Fe; Cr, 16-20; Ni, 3.0 max.; C, 0.15-0.30; Mn, 0.40-0.70							
125	Empire 16	Empire Steel Castings, Reading, Pa.	Fe; Cr, 17-21; Ni, 7-9; C, 0.20 max.; Mn, 0.40-0.70					Annealed casting	75	
126	Empire 17	Empire Steel Castings, Reading, Pa.	Fe; Cr, 26-30; Ni, 3.0 max.; C, 0.15-0.30; Mn, 0.40-0.70					Annealed casting	55	
127	Empire 20	Empire Steel Castings, Reading, Pa.	Fe; Cr, 23-28; Ni, 10-13; C, 0.15-0.20; Mn, 0.40-0.70					Annealed casting	75	
128	Empire 23	Empire Steel Castings, Reading, Pa.	Fe; Cr, 13-17; Ni, 34-37; C, 0.15-0.25; Mn, 0.40-0.70					Annealed casting	60	
129	Esco 45	Electric Steel Fdry. Co., Portland, Ore.	Fe; Cr, 19; Ni, 9; C, 0.15 max.; Mn, 1; Mo, 4.25	8.05	2550	0.84	0.052		95-10	
130	Fahrite C 7	Ohio Steel Fdry. Co., Springfield, Ohio	Fe; Cr, 24-27; Ni, 10-13; C, 0.20 max.; Mn, 1.25 max.	7.8	2650-2750	0.82	0.04		84	
131	Fahrite C 7 M	Ohio Steel Fdry. Co., Springfield, Ohio	Fe; Cr, 24-27; Ni, 10-13; C, 0.20 max.; Mn, 1.25 max.; Mo, 2.5-3.5	7.9	2600-2700	0.82			85	
132	Fahrite C 8 A	Ohio Steel Fdry. Co., Springfield, Ohio	Fe; Cr, 18-21; Ni, 8-10; C, 0.07 max.; Mn, 1	7.7	2600-2700	0.85			80	
133	Fahrite C 8 A M	Ohio Steel Fdry. Co., Springfield, Ohio	Fe; Cr, 18-21; Ni, 8-10; C, 0.07 max.; Mn, 1 max.; Mo, 2.5-3.5	7.8	2600-2700	0.85			90	
134	Fahrite C 12	Ohio Steel Fdry. Co., Springfield, Ohio	Fe; Cr, 12-14; Ni, 1.0 max.; C, 0.16 max.; Mn, 1.0 max.	7.6	2700-2800	0.56			100	
135	Fahrite C 73	Ohio Steel Fdry. Co., Springfield, Ohio	Fe; Cr, 28-30; Ni, 8-10; C, 0.20-0.30; Mn, 1.0 max.	7.8	2650-2750	0.84			80	
136	Genesee 212	Symington-Gould Corp., Rochester, N. Y.	Fe; Cr, 14; C, 0.15; Mn, 0.50; Mo, 0.20	7.72					100	
137	Genesee 255	Symington-Gould Corp., Rochester, N. Y.	Fe; Cr, 5; C, 0.20; Mn, 0.70; Mo. 0.50	7.78					110	
138	Genesee 304	Symington-Gould Corp., Rochester, N. Y.	Fe; Cr, 17; Ni, 35; C, 0.45; Mn, 0.65							
139	Genesee 305	Symington-Gould Corp., Rochester, N. Y.	Fe; Cr, 17; Ni, 65; C, 0.35; Mn, 0.60							
140	Genesee 412	Symington-Gould Corp., Rochester, N. Y.	Fe; C, 1.10; Mn, 11-14			1.0	0.027	Cast	80-14	
141	Hard Facing Rod 217	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; C; Cr; Mn; W; Mo							
142	Hard Facing Welding Rod 459	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; C; Cr; Mn; Mo		2450-2600					
143	Hoskins 502	Hoskins Mfg. Co., Detroit, Mich.	Fe; Cr, 18.5; Ni, 35; C, 0.40, Mn, 1.5	7.9	2450	0.89		Hot rolled Casting	110 70	
144	Ing Aclad Stainless Clad Steel 304	Ingersoll Steel & Disc Div., Borg Warner Corp., Chicago, Ill.	Fe; Cr, 18-20; Ni, 8-10; C, 0.08 max.	7.92	2550-2750			Sheets and plates	60-70	
145	Ing Aclad Stainless Clad Steel 309	Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.	Fe; Cr, 22-26; Ni, 12-14; C, 0.20 max.; Mn, 2 max.	7.90	2700			Sheets and plates	60-70	
146	Ing Aclad Stainless Clad Steel 317	Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.	Fe; Cr, 18-20; Ni, 10-14; C, 0.10 max.; Mn, 2 max.; Mo, 3-4	7.92	2700			Sheets and plates	60-70	
147	Ing Aclad Stainless Clad Steel 347	Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.	Fe; Cr, 17-20; Ni, 8-12; C, 0.10 max.; Mn, 2 max.; Cb, 10 x C	7.92	2700			Sheets and plates	60-70	

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in.	30 min.		29	170 max.	Fair	DD, F, R, W	B, C, P, S, R, T, W	Semi-stainless alloy specifically developed for oil cracking and hydrogenation													
45	25-35		28	135-160	Fair	DD, F, R, W	B, C, HR, D, S, R, T, W	May be hardened and tempered to good physical properties													
in.	35		28	135-175	Fair	DD, F, R, W	B, C, CR, HR, P, S, R, T, W	This alloy is used for sulphite liquors and catalytic oil cracking													Room Boiling
90	27-34		26	140-180			B, C, P, S, R, T, W														Room Boiling
in.	30		28	150	Fair	DD, F, R, W	B, C, CR, HR, P, S, R, T, W	Room Boiling	R	R				Room Boiling	R						Room Boiling
in.	35		29.7	115-175	Fair	DD, F, R, W	B, C, HR, P, S, R, T, W	Room Boiling	R	R											Room Boiling
30	15-30		29	160-195	Fair	F, W	B, C, P, S, R, T, W	Room Boiling	R												Room Boiling
					Good		C	Room Boiling	.012 .022					Room Boiling	.105 .142						
	35	40		180	Good		C														Room Boiling
	35	40		180	Good		C	Room Boiling	R	R R	R		R	Room Boiling	R						Room Boiling
	5	6	24	170	Good		C	Used primarily for high-temperature applications													
	20	20		185	Fair		C	Room Boiling	R R	R			R								Room Boiling
	1				Good		C	Room Boiling					R								Room Boiling
	5	5			Good		C														Room Boiling
	20	15		190	Good		C	For high-temperature uses such as tube supports for oil cracking stills and furnace parts													
	25	30		195	Fair		C	Room Boiling	R R	R			R								Room Boiling
	5	5		180	Fair	W	C														Room Boiling
0	40-55	40-55		130-150	Fair	W	C														Room Boiling
5	40-50	45-55		140-160	Fair	W	C														Room Boiling
					Poor	W	C	Room Boiling	R R	R R	R R	R R	R R	R R	Room Boiling	R	R	R	R	R	Room Boiling
0	35-50	40-55		130-150	Fair	W	B, C, HR, D, P, S, R W	Room Boiling	R R	R R	R R	R	R	R R	Room Boiling	R	R	R	R	R	Room Boiling
					Poor	W	C	Room Boiling	R R	R R	R R	R R	R R	R R	Room Boiling	R	R	.008	.009	.010	Room Boiling
	7	10		180	Good		C	Used primarily for high-temperature applications													
				450-550	Poor	W		Can be welded to carbon steel and forged — Resists extreme shock and abrasion													
				500				Used for its abrasion resistance for pulverizers (Coal, cement, etc.)														
				650-700				Used for its abrasion resistance for pulverizers (Coal, cement, etc.)													
				650-700				Used for its abrasion resistance for pulverizers (Coal, cement, etc.)													
	20-25	25-30		225	Fair	W	C														
	15-20	30-35		230	Fair	W	C														
	15-25	30-35		200	Fair	W	C														
	20-25	45-50		225	Fair	W	C														
						W															
	50-55	60-65		165	Fair	W	C														
	1-2	3-4		180	Fair	W	C														
	35-40	40-50		175	Fair	W	C														
	30-35	35-40		180	Fair	W	C														
	40	40	30	217	Good		C														
	25	24	25	160	Fair		B, C	Room Boiling	R	R.0025	R.005			Room Boiling	R	.06					Room Boiling
	27	26.5	25	170	Fair		B, C	Room Boiling	R R	R.0001 .08	R.001 .4			Room Boiling	R R	R.0001 R.004					Room Boiling
	50	60	28	160	Fair		C	Room Boiling		0.2	0.7			Room Boiling							Room Boiling
	50	60	28	170	Fair		C	Room Boiling	R	R.002	R.003			Room Boiling	R	R.0007					Room Boiling
	30	35	29	179-400	Fair		C														
	10	10	29	200	Fair		C	Room Boiling	R	R.004	.03			Room Boiling		.08					Room Boiling
	25	30		200	Good		C														
	20-25	50-55		180-200	Fair																
					Fair																
					Fair		C														
	25-35	30-40		170-200	Poor		C														
				600-700	Poor		Welding rod	For resisting extreme abrasion at temperatures up to 1000 deg. F. Not recommended where extreme shock or impact													
				500-600	Poor		Welding rod	Hard facing for all wearing parts not subjected to temperatures over 800 deg. F.													
					Good			Primarily used for high-temperature applications													
	30-50	50-60	29	145-160	Fair	DD, F, R, W, B	HR, P, S	Room Boiling	R	R			R								Room Boiling
	30-50	50-60	29	130-200	Poor	DD, F, R, W, B	HR, P, S	Room Boiling	R	R			R								Room Boiling
			29	145-175	Poor	DD, F, R, W, B	HR, P, S	Room Boiling	R	R			R								Room Boiling
	30-50	50-60	29	145-160	Poor	DD, F, R, W, B	HR, P, S	Room Boiling	R	R			R								Room Boiling

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138	**Genesee 304**	Symington-Gould Corp., Rochester, N. Y.	Fe; Cr, 17; Ni, 35; C, 0.45; Mn, 0.65						
139	**Genesee 305**	Symington-Gould Corp., Rochester, N. Y.	Fe; Cr, 17; Ni, 65; C, 0.35; Mn, 0.60						
140	**Genesee 412**	Symington-Gould Corp., Rochester, N. Y.	Fe; C, 1.10; Mn, 11–14			1.0	0.027	Cast	80–
141	**Hard Facing Rod 217**	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; C; Cr; Mn; W; Mo						
142	**Hard Facing Welding Rod 459**	Amer. Manganese Steel Co., Chicago Heights, Ill.	Fe; C; Cr; Mn; Mo		2450–2600				
143	**Hoskins 502**	Hoskins Mfg. Co., Detroit, Mich.	Fe; Cr, 18.5; Ni, 35; C, 0.40, Mn, 1.5	7.9	2450	0.89		Hot rolled Casting	11 7
144	**Ing Aclad Stainless Clad Steel 304**	Ingersoll Steel & Disc Div., Borg Warner Corp., Chicago, Ill.	Fe; Cr, 18–20; Ni, 8–10; C, 0.08 max.	7.92	2550–2750			Sheets and plates	60–
145	**Ing Aclad Stainless Clad Steel 309**	Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.	Fe; Cr, 22–26; Ni, 12–14; C, 0.20 max.; Mn, 2 max.	7.90	2700			Sheets and plates	60–
146	**Ing Aclad Stainless Clad Steel 317**	Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.	Fe; Cr, 18–20; Ni, 10–14; C, 0.10 max.; Mn, 2 max.; Mo, 3–4	7.92	2700			Sheets and plates	60–
147	**Ing Aclad Stainless Clad Steel 347**	Ingersoll Steel & Disc Div., Borg-Warner Corp., New Castle, Ind.	Fe; Cr, 17–20; Ni, 8–12; C, 0.10 max.; Mn, 2 max.; Cb, 10 x C	7.92	2700			Sheets and plates	60–
148	**Manganese-Molybdenum Steel**	Lukens Steel Co., Coatesville, Pa.	Fe; C, 0.25 max.; Mn, 1.65 max.; Mo, 0.75 max.; Si, 0.25 max.					Plates	9
149	**Mayari R**	Bethlehem Steel Co., Bethlehem, Pa.	Fe; Cr, 0.2–1.0; Ni, 0.25–0.75; C, 0.12 max.; Cu, 0.5–0.7; Mn, 0.5–1					Hot rolled	70
150	**Midvaloy 13**	Midvale Co., Nicetown, Philadelphia, Pa.	Fe; Cr, 12–14; C, 0.12 max.; Ni, 0.50 max.; Mn, 0.50 max.	7.77	2700–2750	0.6	0.06	Heat treated wrought bars	80–
151	**Midvaloy 18-8**	Midvale Co., Nicetown, Philadelphia, Pa.	Fe; Cr, 18–20; Ni, 8–10; C, 0.20 max.; Mn, 0.60 max.	7.86	2550–2990	0.91	0.04	Annealed wrought & cast bars	70–
152	**Midvaloy 18-8 Se**	Midvale Co., Nicetown, Philadelphia, Pa.	Fe; Cr, 17–19; Ni, 8.5–9.5; C, 0.12 max.; Se, 0.22–0.26; Mn, 0.8–1.2	7.86	2550–2990	0.91	0.052	Annealed wrought bar	8
153	**Midvaloy 1700**	Midvale Co., Nicetown, Philadelphia, Pa.	Fe; Cr, 15–18; C, 0.12 max.; Mn, 0.50 max.	7.71	2700–2750	0.57	0.06	Annealed wrought and cast bars	65–
154	**Midvaloy 17-35**	Midvale Co., Nicetown, Philadelphia, Pa.	Fe; Cr, 17; Ni, 35; C, 0.35	7.93		0.74	0.03	Castings	55–
155	**Midvaloy 25-12**	Midvale Co., Nicetown, Philadelphia, Pa.	Fe; Cr, 23–26; Ni, 11–13; C, 0.25 max.; Mn, 0.4–0.6	7.86	2550–2590	0.90	0.035	Bars and castings	70–
156	**Midvaloy 25-20**	Midvale Co., Nicetown, Philadelphia, Pa.	Fe; Cr, 24–26; Ni, 19–21; C, 0.25 max.	7.8		0.8		Wrought and cast bars	85–
157	**Midvaloy 2882**	Midvale Co., Nicetown, Philadelphia, Pa.	Fe; Cr, 25–30; Ni, 2.0 max.; C, 0.35 max.; Mn, 0.2–0.5	7.6	2650–2700	0.59	0.05	Castings	75–
158	**Midvaloy ATV 3**	Midvale Co., Nicetown, Philadelphia, Pa.	Fe; Cr, 14; Ni, 26.5; C, 0.48; W, 3.5	8.12		0.78		Wrought bars	100–
159	**Misco 18-8**	Michigan Steel Casting Co., Detroit, Mich.	Fe; Cr, 18–20; Ni, 8–10; C, 0.07–0.16 [3]; Mo, or Cb					Room temperature, quench annealed	7
160	**Misco C**	Michigan Steel Casting Co., Detroit, Mich.	Fe; Cr, 27–30; Ni, 8–10; C, 0.20–0.30					Room temperature, as cast	8
161	**Misco HN-1**	Michigan Steel Casting Co., Detroit, Mich.	Fe; Cr, 16–20; Ni, 66–70; C, 0.50–0.80						6
162	**Misco HN-2** [3]	Michigan Steel Casting Co., Detroit, Mich.	Fe; Cr, 10–14; Ni, 58–62; C, 0.50–0.80	8 13				Room temperature, as cast	6
163	**Misco Metal** [3]	Michigan Steel Casting Co., Detroit, Mich.	Fe; Cr, 15–17; Ni, 35–37; C, 0.40–0.60	7.94		0.63		Room temperature	6
164	**Miscrome 1**	Michigan Steel Casting Co., Detroit, Mich.	Fe; Cr, 13–15; C, 0.25–0.35; Ni, 0.60 max.					Room temperature Normalized and tempered	9
165	**Miscrome 4**	Michigan Steel Casting Co., Detroit, Mich.	Fe; Cr, 11.5–13; C, 0.12 max.; Ni, 0.80 max.					Air quenched and tempered, room temperature	8
166	**Nichrome**	Driver Harris Co., Harrison, N. J.	Fe; Cr, 15; Ni, 60	8.25	2460	0.76	0.03	Wrought	95–
167	**Nichrome**	Driver Harris Co., Harrison, N. J.	Fe; Cr, 11–13; Ni, 59–61	8.15	2460	0.62	0.033	Casting	6
168	**2% Nickel Steel**	Lukens Steel Co., Coatsville, Pa.	Fe; Ni, 2.0 min.; C, 0.20 max.					Plates	
169	**Ni-Hard**	International Nickel Co., New York, N. Y.	Fe; Ni, 4.4–4.6; C, 2.75–3.6; Cr, 1.4–1.6; Si, 0.5–1.5	7.40	2150–2250			Casting	30–
170	**Nilstain**	Wilber B. Driver Co., Newark, N. J.	Fe; Cr, 18–20; Ni, 8–10; C, <.20; Mn, 2 max.	7.9		0.95	0.048	Annealed wire	85–
171	**Ni-Resist**	International Nickel Co., New York, N. Y.	Fe; Ni, 13–15; Cu, 5.5–7; C, 2.95–3.10; Cr, 1.5–2.5; Mn, 1–1.75	7.4	2150	1.03	0.095	Casting	25–
172	**Pyrocast**	Pacific Fdry. Co., San Francisco, Calif.	Fe; Cr, 22–30; C, 1.75–2.0	7.54	2550–2700			Casting	60–
173	**Q Alloy A**	General Alloys Co., Boston, Mass.	Fe; Cr, 17; Ni, 68; C, 0.60; Mn, 1.0	8.20	2200–2800	0.59	0.033	Casting	6
174	**Q Alloy B**	General Alloys Co., Boston, Mass.	Fe; Cr, 13; Ni, 60; C, 0.60; Mn, 1.0	8.13	2700–2800	0.64	0.033	Casting	6
175	**Q Alloy CN-1**	General Alloys Co., Boston, Mass.	Fe; Ni, 12; C, 0.10 max.[4]; Cb, Se, or Ti if specified	7.81	2660–2710	0.90	0.055	Casting	8
176	**Q Alloy CN-1-H**	General Alloys Co., Boston, Mass.	Fe; Cr, 28; Ni, 10; C, 0.30 [4]	7.65		0.88		Casting	8
177	**Q Alloy CN-1-Mo**	General Alloys Co., Boston, Mass.	Fe; Cr, 24; Ni, 12; C, 0.10 max.[4]; Mo, 1–4; Cb, Se, or Ti	7.81	2660–2710	0.90	0.055	Casting	8
178	**Q Alloy CN-2**	General Alloys Co., Boston, Mass.	Fe; Cr, 18; Ni, 8; C, 0.10 max.[4]; Cb, Se, or Ti if specified	7.70		0.92		Casting	7
179	**Q Alloy CN-2 Mo**	General Alloys Co., Boston, Mass.	Fe; Cr, 18; Ni, 8; C, 0.10 max.[4] Mo, 1–4; Cb, Se, or Ti	7.70		0.92		Casting	7
180	**O-4**	Otis Elevator Co., Buffalo, N. Y.	Fe; Cr, 4–8; C, 0.15–0.35; Mo, 0.25–2; Mn, 0.45–0.85	7.78–7.82	2640–2660	0.62		Cast bar	100–
181	**O-12**	Otis Elevator Co., Buffalo, N. Y.	Fe; Cr, 11–14; C, 0.12–0.35; Mn, 0.4–0.6	7.65–7.75	2723–2750	0.61		Cast bar, heat treated	75–
182	**O-16**	Otis Elevator Co., Buffalo, N. Y.	Fe; Cr, 14–18; C, 0.12 max.; Mn, 0.5 max.		2714–2730		0.057	Heat treated casting	70–
183	**O-18**	Otis Elevator Co., Buffalo, N. Y.	Fe; Cr, 18–20; Ni, 8–10; C, 0.08–0.20; Mn, 0.5–0.6	7.86–7.94	2606–2679	0.96	0.069	Casting water quenched, 2000 deg. F.	78–
184	**O-24**	Otis Elevator Co., Buffalo, N. Y.	Fe; Cr, 22–25; Ni, 10–13; C, 0.20 max.	7.86–7.94	2552–2597	0.9	0.039	Heat treated casting	80–
185	**O-30**	Otis Elevator Co., Buffalo, N. Y.	Fe; Cr, 25–30; C, 0.25 max.; Mn, 1.0 max.				0.059	Casting, stress relieved	45–
186	**Sivyer 5% Cr**	Sivyer Steel Castings Co., Milwaukee, Wis.	Fe; Cr, 4.5–6.5; C, 0.25 max.; Mo, 0.45–0.65					Heat treated casting	100–
187	**Sivyer 60**	Sivyer Steel Castings Co., Milwaukee, Wis.	Fe; Cr, 18; Ni, 8; C, 0.12 max.; Mn, 0.60 max.	7.85	2600–2700	0.90		Heat treated casting	70–
188	**Sivyer 62**	Sivyer Steel Castings Co., Milwaukee, Wis.	Fe; Cr, 23–25; Ni, 11–13; C, 0.20 max.; Mn, 0.60 max.	7.8	2600–2700	0.90		Casting	75–

1 Stable solutions only. 2 Depending on service. 3 Composition given is for castings. 4 Higher c

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INDUSTRY ORGANIZES
For National Defense

ALERT to what is happening in Europe, the American people are setting out to strengthen their defenses against aggression from any quarter. Already the government has laid down an initial program to that end.

The surest defense against aggression is the ability to resist it. If we are known to be well prepared we may avert attack. If we cannot avert it we shall be armed against it. But preparedness against war means preparedness to wage war.

And modern war is an industry. Like every other industry, it is a matter of men, materials and machines. Fighting men must be skilled workers, trained to use an arsenal of special tools and equipment that are just as diversified and just as essential to success as those of any other industry.

The plant, supplies and personnel of war must rival in efficiency those of any peacetime industry. For the stakes of success or failure in war are not paid in money profits or losses: they are paid in the lives and property of the people, in the security — perhaps the survival — of a nation.

* * *

Sound national defense calls first for a comprehensive program, carefully planned to back up a clear-cut policy as to what we expect to defend. Next comes the appropriation of funds to realize that program. These first steps are vital: they are up to government.

Then program and appropriations must be translated into performance. Native raw materials must be produced, processed and stored. Our meager supplies of strategic materials of foreign origin must be built up until we have accumulated ample stockpiles against the use and wastage of active war. And most urgent, because it is most complicated, raw materials must be manufactured into the innumerable items required to equip the modern army.

We of McGraw-Hill, living with American industry as we do, are keenly aware of the effort that will be required to produce the materials and equipment now needed to modernize our national armament.

Tanks and anti-tank guns, airplanes and anti-aircraft guns, machine guns and automatic rifles, trucks and tractors, destroyers and supply ships — these are but a few items from the endless inventory of military and naval equipment that we must produce by scores, hundreds and thousands, even to arm an Initial Protective Force, behind which we might rally our national resources for decisive effort.

Obviously the army and navy must count on American industry for an ample and continuous supply of this equipment, and industry must organize to produce it in vast quantities. This means the construction and adaptation of manufacturing, transportation and storage facilities, the organization of competent executive and technical staffs, the training of skilled craftsmen in numbers adequate to maintain exacting production schedules. All this, in itself, is an industrial organization problem of the first magnitude, but upon it is imposed still another and vital specification — *sustained speed*.

For time is the all-essential ingredient of modern war. It cannot be bought with any appropriation, however great; once lost, it cannot be recaptured; we must make effective use of it while we still have it. And at this juncture we have none to waste in fumbling, jockeying or experiment.

* * *

Two courses are open to carry out such a program.

1. We might adopt the totalitarian plan of nationalizing industry, conscripting the wealth and labor of all, and suppressing the normal incentives and management of industry in favor of the authority and control of government officials.

2. Or we can stick to the American way of achieving national unity and efficiency by intelligent cooperation between industry, labor and government.

There are those to whom the first will appeal as being the more direct. But I am convinced that most Americans will insist that the job be done in the American way. And in this preference the President, speaking for government, already has indicated his concurrence.

But effective cooperation in so complex and unfamiliar a task demands the utmost of mutual understanding and confidence from all concerned. Confusion of purpose and conflict of opinion are bound to arise — have, indeed, already arisen. Needs and capacities in many fields must be reconciled, relative priorities for various products must be determined, specific parts of the whole program must be allocated, supervised and coordinated with other parts. Government officials, smarting under the whip of urgency, must render quick decisions on highly technical matters, while industrial executives, masters of their own operating technique, must adapt themselves to arbitrary and unfamiliar requirements.

Under such conditions, many problems will arise that must be worked out between the men of industry and those of government. Some of them will be the more acute because of the restrictions under which industry has had to work during recent years—restrictions that have curbed not only the expansion of plant capacity, but also the development of improved processes and the supply of skilled workers. Now, from this sag in our industrial growth, many departments of industry must undertake an overnight expansion of capacity to meet the exacting time schedules of national defense. So industry must look to government for the cooperation that will enable it to expand its facilities promptly and yet write off in reasonable time its heavy emergency investments.

* * *

If we are to deal wisely with these situations, and many more we cannot now foresee, everyone engaged in any part of the defense effort must be willing and able at all times to get a fair understanding of the problems of the others. To help maintain such an understanding McGraw-Hill is peculiarly fitted.

1. By the organized exchange of views and information among our 24 papers, we can help to coordinate the thinking and practice of the 1,000,000 executives, technicians and operating men who are their readers, in matters that have to do with their part in the defense project.

2. Through constant contact with government agencies and the men of industry, our papers can interpret to industry the needs and policies of government and to government the problems and requirements of industry.

3. For the men of industry, each of our papers will expand its regular service as a clearing house of technical and operating data, with special reference to the needs of plants that are producing defense materials and equipment.

To forward these objectives we have set up within our company a National Defense Editorial Board. It is composed of the chief editors of our publications that serve the functions and industries that are of key importance to the defense effort. Made up of men intimately familiar with the personnel and practice of their industries, this board will stimulate and supervise the activities of McGraw-Hill papers insofar as they can contribute to the defense effort. It will outline basic editorial themes, directed to the forwarding of that project, to be adapted by each paper to the special needs of its specific field.

The board will keep close touch with industrial executives and technicians so as to keep abreast of new problems as they arise. It will maintain contact also with government defense agencies and keep our editors posted as to government objectives, plans and problems. Thus it will function as a link between the several governmental defense agencies and the McGraw-Hill editorial organization, and so help each editorial staff to develop a program best suited to the special problems of its industry.

* * *

In thus undertaking our part in an extraordinary industrial effort, we shall not neglect the normal concerns of American industry. So far as may be consistent with the paramount needs of national defense, production and distribution of the goods and services normally consumed by the American people must go on. The effort to mobilize industry for the national defense must be, in large measure, an additional job and an added burden.

That burden is within the capacity of the American people. But it will not be light. And if industry is to carry successfully its heavy share of that burden, it needs the full cooperation of every industrial function.

For more than seventy-five years, through peace and war, McGraw-Hill publications have served to interpret between the various departments of industry and between industry and the American people. Today, as we face these new problems, there is a new and urgent need for interpretation between the industries we serve and the government to which we all bear allegiance. It is fitting that McGraw-Hill should undertake this effort. To it I pledge every resource of our organization.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

This message is appearing in all McGraw-Hill industrial and business publications, reaching over a million readers.

CHALLENGE TO INDUSTRY'S PATRIOTISM

Calls for Plain Speaking

IT is a pity that the greatest national defense effort in American history had to be made during a presidential election campaign. For a modern defense effort involves an intensely practical industrial project, while an election campaign involves an intensely emotional political propaganda. And those two don't mix.

That, as I see it, is the chief reason for the welter of claims and denials, charges and counter-charges that have been getting in the way of contracts for planes, tanks, guns and all the rest of the armament for which the American people are so nervously peering down the road.

We are told that the managers of industry, smarting and suspicious under the repeated attacks of government officials for some years back, have been reluctant to assume the abnormal risks of defense contracts without commensurate safeguards, and that the politicians who must authorize those safeguards have been reluctant to do anything that might be construed as letting down the bars for unscrupulous business men to exploit the national emergency. For the one, the business risks of full speed ahead have been too great; for the other, the political risks of full speed ahead have been too great. So we don't go full speed ahead.

This is not written to increase that clamor of recrimination on either side. On the contrary, it is an appeal for some decent and thoughtful consideration on the part of all concerned—consideration for the urgent needs of the nation, for the problems and responsibilities of both the politicians and the industrialists, for the elementary principles of prudent business management, and for the good opinion of the man on the street. He is neither a politician nor an industrial executive. But his hide and his pocketbook are at stake in the national defense program—and he knows it. He has a right to the low-down on what is going on. And if he is left in ignorance or deliberately deceived, for the sake of either political or business whoopee, the payoff will be mighty poisonous political medicine for the politicians and equally poisonous business medicine for the business men who may be responsible.

* * *

The plain stark fact, to be faced squarely by us all, is that the national defense program is an emergency project—a desperately urgent emergency project.

As in every emergency that confronts a democracy, we are harassed by a confusion of counsel. As always, some of the confusion arises from honest but conflicting judgments, some of it from ignorance or muddy thinking. But, unhappily, much of it reflects the deliberate purpose of self-seekers to fish in troubled waters—to capitalize the conjunction of a national emergency and a political campaign to boost their own interests. Already the charge that American business men are unpatriotic and interested only in profit has been put out as a smokescreen to cover up deficiencies for which business men are in no way responsible.

Now the man on the street finds it hard to see through this maze of excited contradiction. Not because he isn't smart—the average American can think straight enough *when he has the facts*. But in this case the facts are obscure and complicated—they have to do with matters that are strange to him. And to make it worse, at the height of his confusion, raucous voices constantly assail his ear with "simple" explanations of it all. But, as so often happens, most of these "simple" explanations make the matter a lot simpler than it really is.

* * *

Consider, for example, the cry that "industry refuses to get busy on national defense until its profits are guaranteed". Very clear and simple, to be sure; but also very false. The charge that American capital is "on strike" in the hour of national need. As silly as it is simple. The assertion that our manufacturers "won't even talk with a government anxious to place orders with them, without large financial concessions", and that "American corporate industry refuses to expand its resources for defense until it receives immunity from proper taxation". The resounding demand that we "conscript wealth as well as men"—whatever that may mean.

Particularly political has been the attack on the aircraft industry. It has been made to appear that aircraft manufacturers were instituting a sit-down strike because, in their greed for profits, they demanded more than 8%. Actually the 8% was not a net profit at all and the only concern of the manufacturers was to fight against incurring losses under the 8% limitation. And army and navy officers have sustained the aircraft manufacturers' viewpoint.

The air is full of explanations which, however simple they may sound, do not explain. And in most cases, I am convinced, the purpose of those who offer them is not to explain but to inflame. Those who try honestly to explain these issues from either side, find it impossible to do the job in such ringing phrases.

As I have said, our country has been caught short. As

a result, there are many reasons for the confusion and controversy. The plain fact is that we can produce our war equipment by only two means: (1) by converting the industries of peace into the industries of war, so far as that is possible; and (2) by building from scratch the new facilities we need to supplement them. In other words, we must create—with desperate haste—a new industry in America—an armament industry.

Right there is the crux of the problem that now confronts the industrialist sincerely trying to equip himself for his part in national defense. For this new armament industry is not the ordinary business risk against which he has learned to weigh the interests of his employees and his stockholders. It does not deal with familiar products and processes. It is not continuous—at least it has not been heretofore in this country—and it may fold up as suddenly as it has opened. It cannot hope to serve thousands of potential customers: it has but one sure customer—the United States Government—and wielding the sovereign power that customer can do just about as it pleases with respect to its needs and demands. Which means that not even this one is a *sure* customer.

* * *

No more unfair or deceptive charge ever has been leveled against American industry and American business men than the accusation of being unwilling to take the normal business risks of the defense program. The risks they are trying to minimize—they cannot possibly avoid them all—are very special and extraordinary risks indeed. So clearly is that true, that I doubt very much whether such questions and charges ever would have risen were it not for the fact we are engaged in a political campaign.

Already some of industry's great units have gone ahead with the building of new facilities, the purchase of special materials, and the actual production of armament in the face of all risks, gambling that their government eventually would work out some reasonable plan to protect them against excessive loss. Others, doubtless will follow suit.

But many other companies, for one reason or another, are not in position to do that. So before they begin to expand their facilities to handle defense contracts, they have asked their *only potential customer for those new facilities* to guarantee them—*not* excessive prices, *not* exorbitant profits, *not* immunity from taxation, as we are being told, but simply against the excessive losses that may result from very extraordinary conditions.

* * *

As this is written, it looks as though the legislation and the rulings necessary to accomplish this purpose soon will be forthcoming. Thoughtful and responsible officials of the government understand the situation and what is needed. But, unfortunately, their understanding and action will not quiet the professional business-baiters. So long as those gentlemen have their own interests to serve, so long as political excitement makes it easy to whip up public demand for a scapegoat to atone for disappointing progress with the defense program—just so long will the business-baiters find a receptive audience for their criticisms.

All of which suggests that business men must carry at this time a double responsibility, in addition to their obvious obligation to do the very best job they know how on their individual parts of the defense program.

The first of these added responsibilities is, of course, to avoid any possible basis for the charge that industry is exploiting the defense program in behalf of excessive profit, unfair treatment of labor or any other unworthy self-interest. The second is to see that the man in the street knows and understands all that I have tried to set down in the foregoing.

For the man in the street is deeply involved in all this. He is "in the street" only to the political orators. To the rest of us, he is the man in the factory, the man on the truck, and the man behind the orders that industry fills. In short, he makes up this living American industry on whom the politician's charges spatter. As an employee he has a stake in the solvency, the security, and the reputation of the very plants at which criticism may be directed. Knowing the facts, he can answer the critics so far as his own plant is concerned and can see how the same kinds of facts apply to all industry. If he is a customer, suffering inconvenience as a result of the plant's service to national defense, a knowledge of the facts behind the plant's problems will help to make him a defender rather than a critic of responsible business management. If he is a neighbor in the community, the facts will equip him to be an interpreter of industry's problems to the people of the home town.

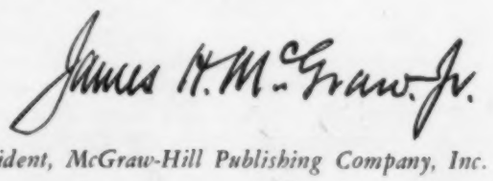
* * *

In this national defense effort, business enters into a new partnership with government, but, more importantly, into a deeper partnership with the American people. It is more than ever essential that it take all of the American people into its confidence, beginning with the people in its plants and going out through the ranks of its customers and its community neighbors to show them that they have a common interest in seeing that the task of national defense is undertaken in the American way.

As we all know, there are in this country some people who would like nothing better than to see American industry fail in this supreme test of service to the nation. They will watch with jealous eyes every move of every company that is engaged on a defense job. They will disparage its achievements, exaggerate its shortcomings, and distort its motives. For they would like to make over American industry to their own pattern, and they'll never have a better chance to get started with it than has been opened up by the national emergency. Or so it looks to them.

So, great as are the business hazards of the defense program for the individual business man, even greater hazards are involved for American industry as a whole. But, knowing the temper of American industrial leadership as I do, I am confident that it will handle its defense assignment with credit to itself and with great advantage to the nation that it serves—whether in war or in peace.

To help in that supreme test is the opportunity and the privilege of the McGraw-Hill organization.



President, McGraw-Hill Publishing Company, Inc.

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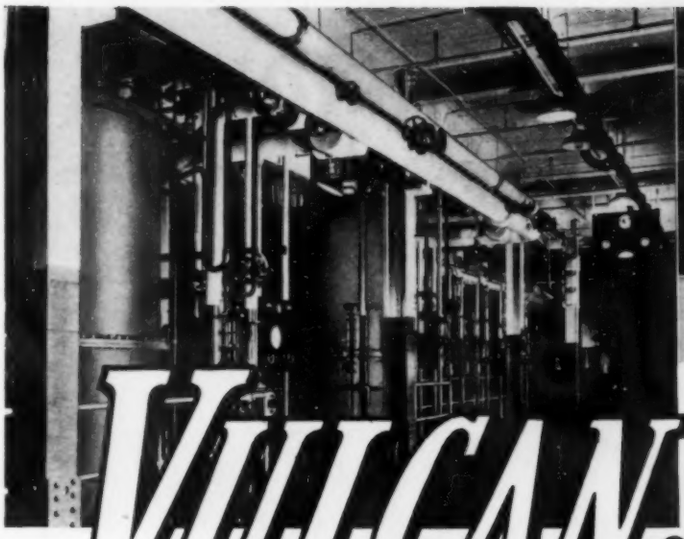

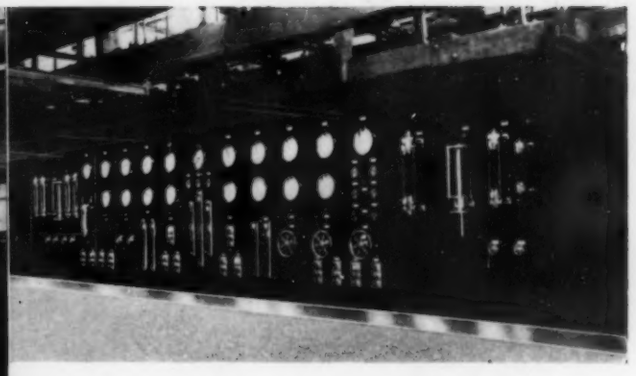

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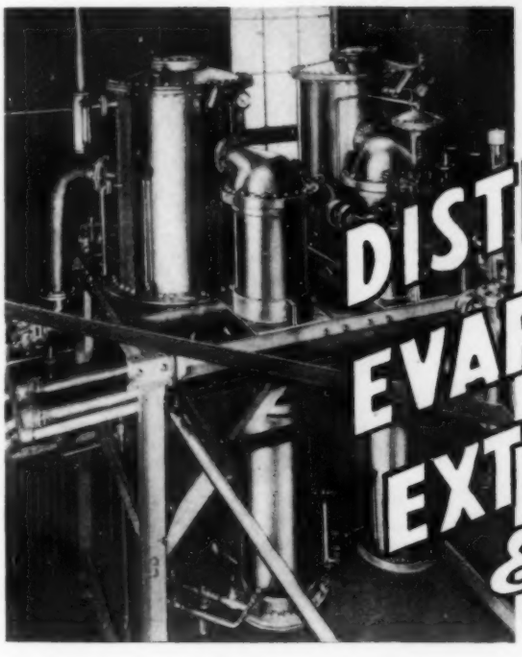

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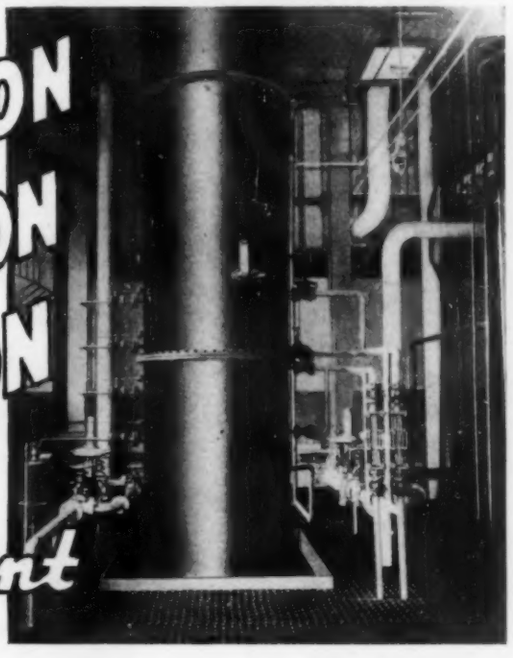

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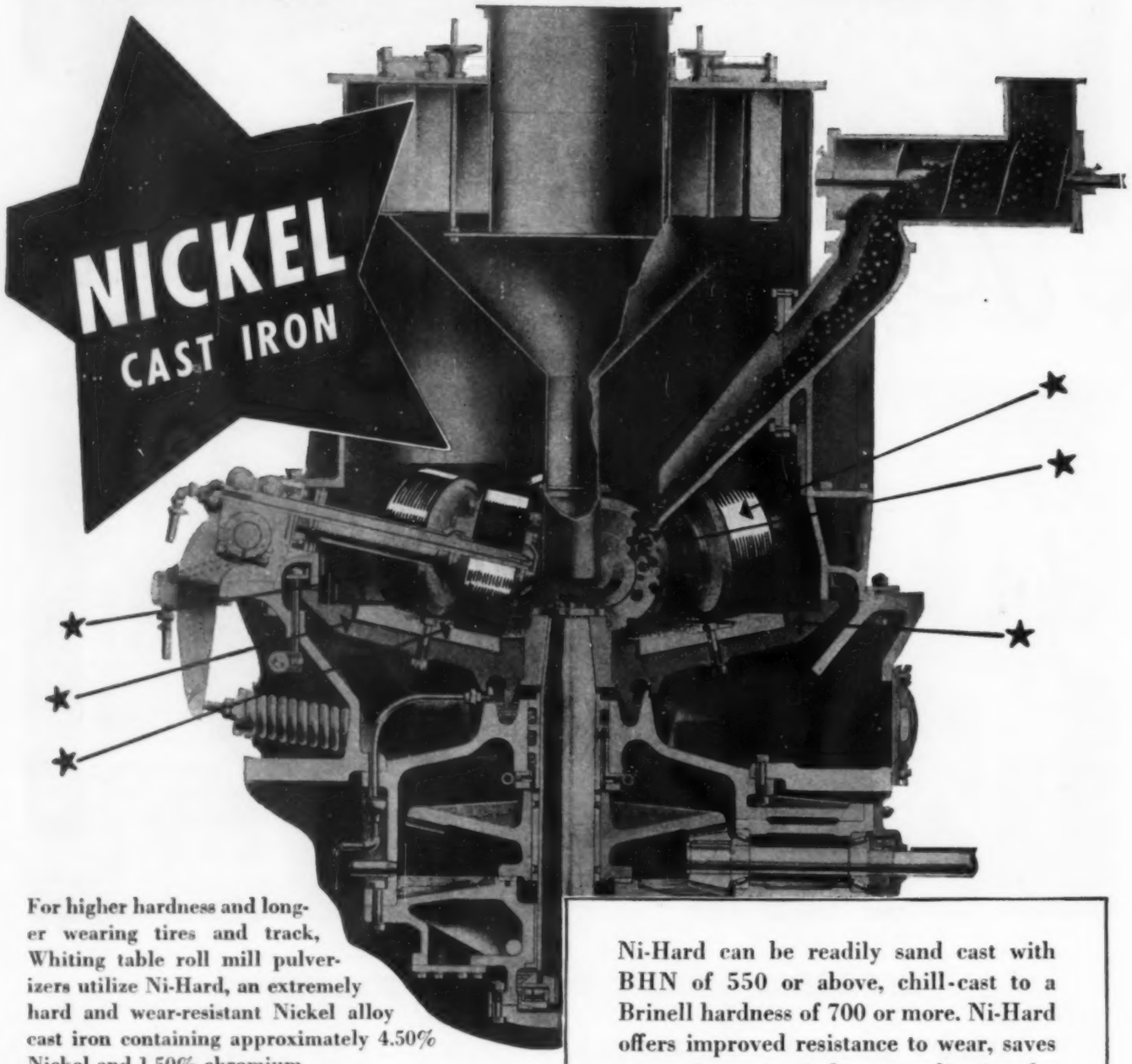

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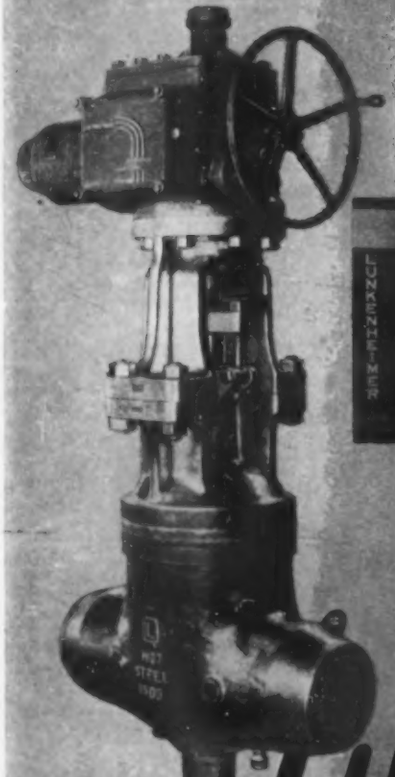

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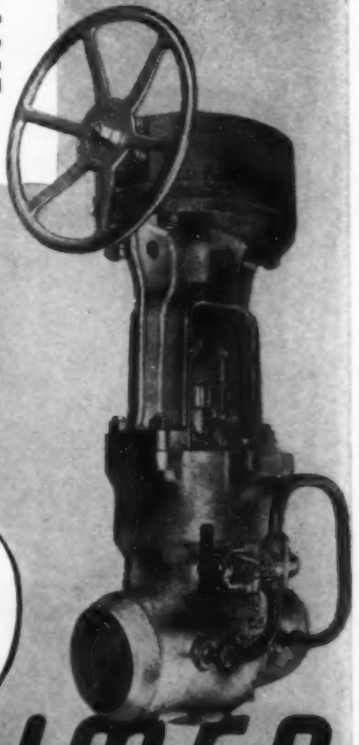

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Link Suspended A T & M Smooth operation with "out of balance" loads. An A T & M-designed link guarantees absolute minimum of foundation vibration. Fume-tight covers; spray pipes; specials.

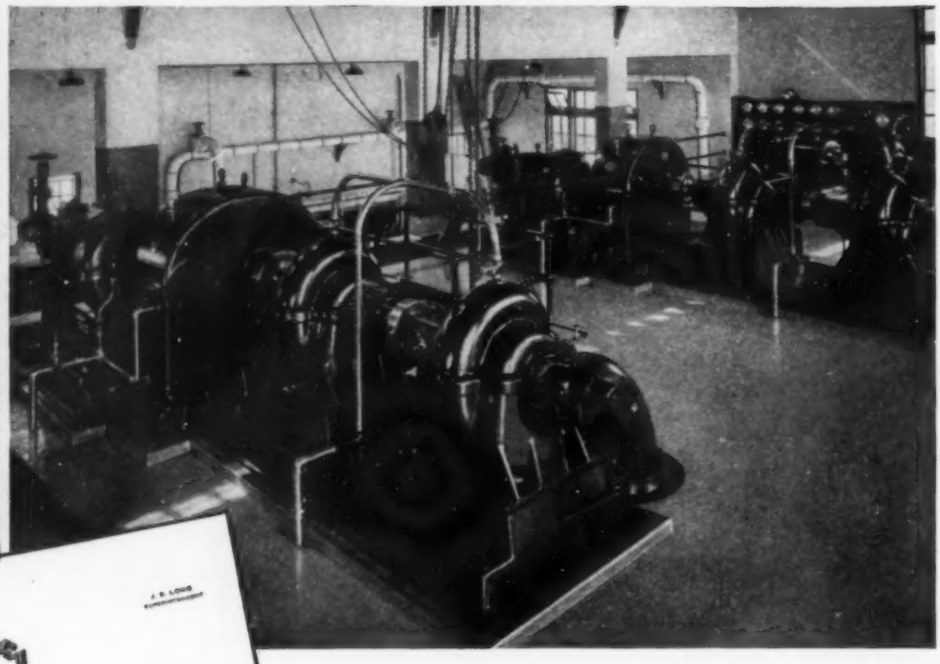
Suspended A T & M For heavy chemical service. Self-discharging baskets, Twin-Speed Regenerative Drive for entire batteries, positive control — and all other accessories when specified. Laboratory units.

Base Bearing A T & M Motors built to A T & M's own specifications. Removable baskets, if desired. Cover cannot open while centrifugal is in use. Easily accessible brakes. Outer casing of solid iron or steel.

A Tip from TAMPA

after 9 Years of "Exceptionally Good Results"

CHIEF WM. B. STUART of Tampa's Water Department pumping station. His hobbies are clock-making and sweet-running turbines. For the latter he specifies *Texaco Regal Oil C.*



THREE DE LAVAL Steam Turbine pumping units in Tampa (Fla.) Water Works. Formerly, the lubricant replaced every 4 years, but now increased to 8 years since changing to *TEXACO REGAL OIL C.*

CITY OF TAMPA
WATER DEPARTMENT

Tampa, Florida, April 3, 1940

The Texas Company,
Atlanta, Georgia.

Gentlemen:

On the ninth anniversary of my change to Texaco Regal Oil "C" in the De Laval Steam Turbine pumping units in the City of Tampa Water Works plant, I felt you would be interested in knowing of the good results I have experienced with your products.

The first supply of Regal Oil "C" was in use continuously for eight years without trouble of any kind. When the time arrived to renew the oil I felt no hesitancy in placing Regal Oil "C" in the system again.

Due to the hard service required of oil in the high speed Turbines and reduction gear sets, I considered it had given exceptionally good results. I would not hesitate to recommend this product to anyone for similar use.

Taking this opportunity of thanking you for the engineering service rendered as well as the cooperation of your laboratory, I am,

Yours very truly,
Wm B. Stuart
Chief Engineer

WBS/s

YOU, TOO, can get similar results in your turbines. Trained lubrication engineers will gladly cooperate in making savings with *Texaco Regal Oils.* Phone the nearest of more than 2300 Texaco warehousing points in the 48 States, or write:

The Texas Company, 135 E. 42nd St., N. Y., N. Y.

TEXACO Regal Oils

TEXACO REG. U.S. PAT. OFF.

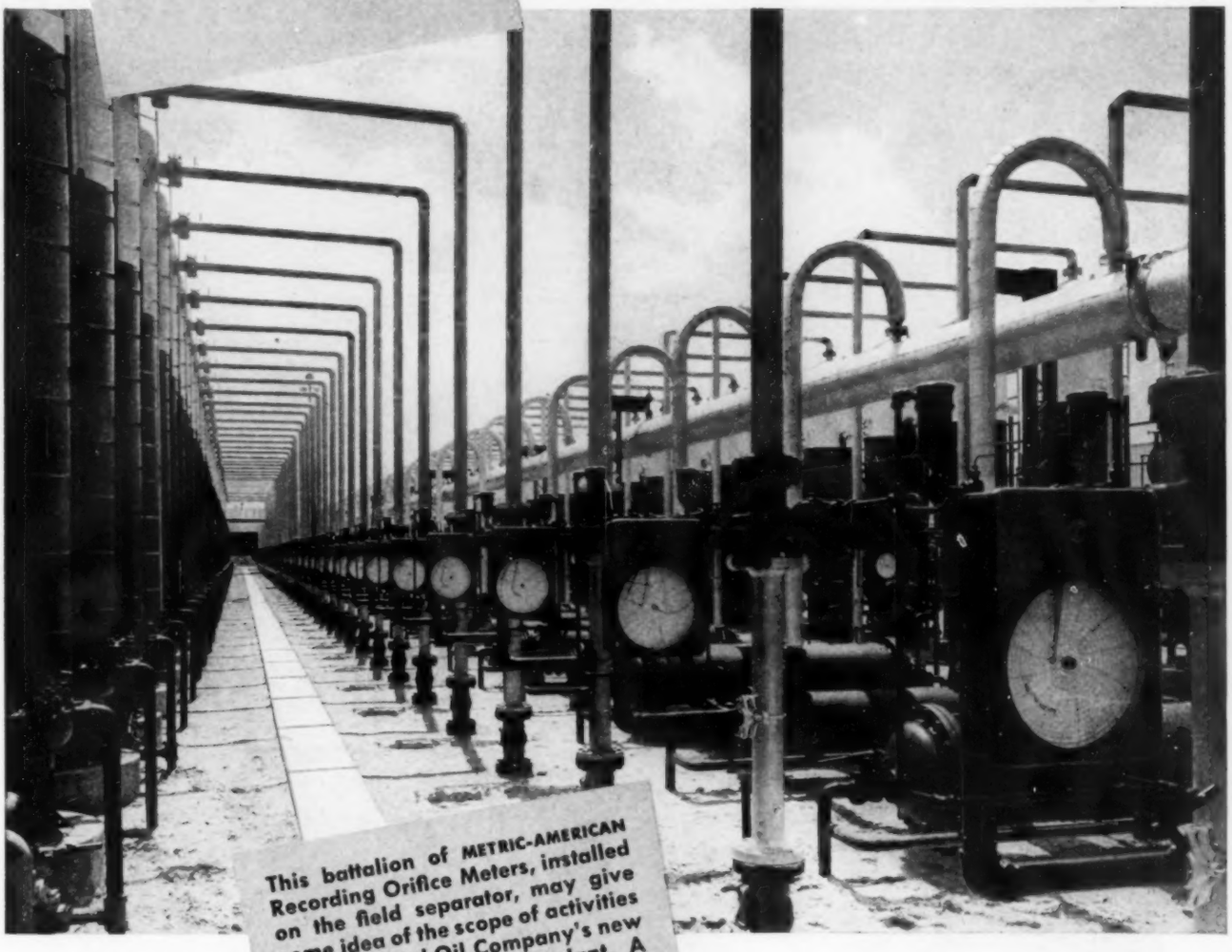
FOR TURBINE LUBRICATION

TEXACO DEALERS INVITE YOU TO ENJOY

FRED ALLEN in a full-hour program every Wednesday night. CBS, 9:00 E.S.T., 8:00 C.S.T., 10:00 M.S.T., 9:00 P.S.T.

METROPOLITAN OPERA every Saturday afternoon, NBC. See local newspaper for time and station.

INDUCTED INTO HARD SERVICE



This battalion of METRIC-AMERICAN Recording Orifice Meters, installed on the field separator, may give some idea of the scope of activities at Continental Oil Company's new Ville Platte (Louisiana) plant. A 8600-horsepower giant which sets new precedents in field stabilization, natural gas recovery and pressure maintenance!

METRIC-AMERICAN has seen service in many a Continental operation. The sustained fine accuracy of the Metric-American Orifice Meter under the most trying field conditions, has called it to service in oil fields and refineries throughout the world. Ease of inspection, cleaning and field adjustment . . . the exceptionally low maintenance cost . . . are factors in its choice. Engineers and maintenance men appreciate a practical instrument that does its job dependably without pampering.

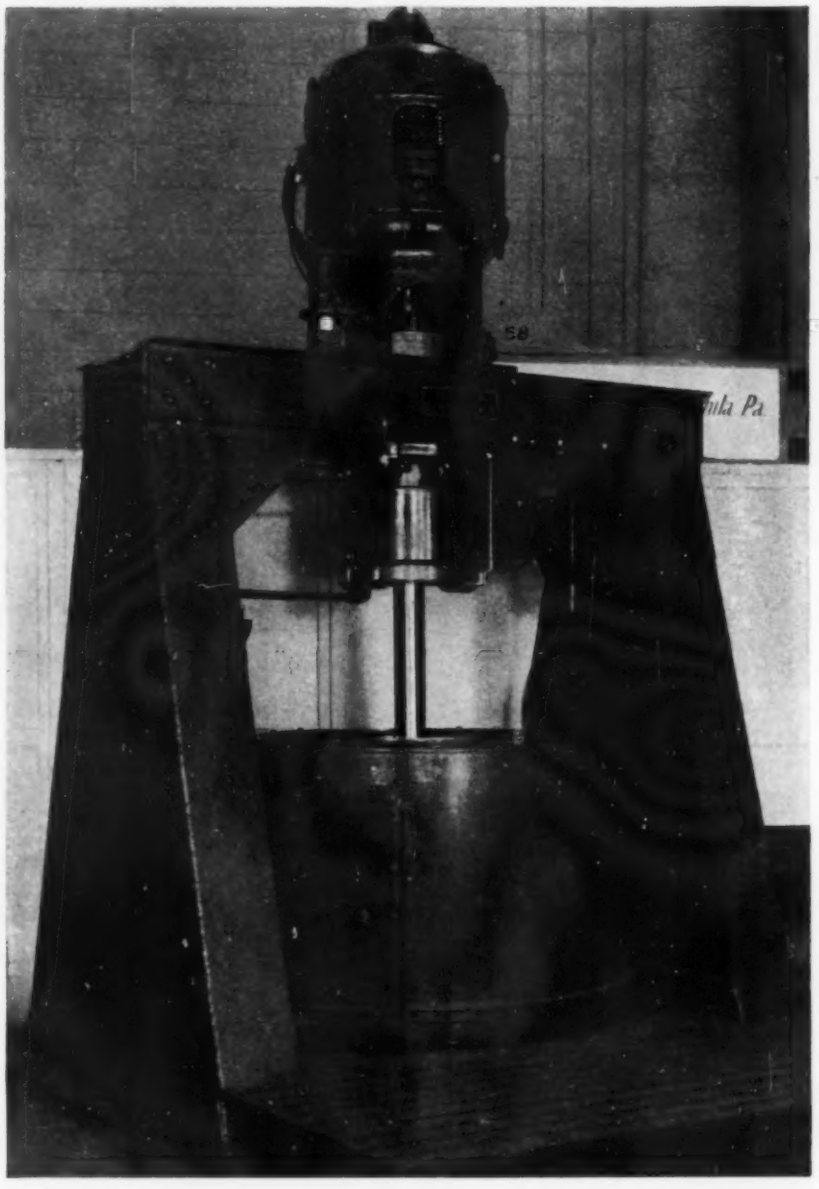
Available upon your request: Helpful and complete technical literature on orific measurement and its modern applications.

METRIC METAL WORKS • ERIE, PA.

AMERICAN
METER COMPANY
INCORPORATED (ESTABLISHED 1836)

1518

Spindle smoothness
ON *Fletcher* CENTRIFUGALS
comes from SKF BEARINGS



The SKF Deep-Groove Ball Bearings on this machine, built by FLETCHER WORKS, INC., are designed to take heavy thrust loads. They never require adjustments . . . never lose their close factory settings.

A CENTRIFUGAL is no better than its spindle. And its spindle is no better than its bearings.

So you can easily calculate the value of this Fletcher Motor Driven Suspended Centrifugal when we tell you that its spindle gets its extremely smooth-running characteristics from two SKF Bearings.

The three letters "SKF" are your warranty of *dependable* BEARING performance—and, therefore, of *peerless* SPINDLE performance . . . of *profitable* CENTRIFUGAL *performance*. Where performance is a MUST, the bearings are SKF. 4674

SKF
BALL & ROLLER BEARINGS

SKF INDUSTRIES, INC., FRONT ST. & ERIE AVE., PHILA., PA.

HERE'S THE FILTER CONSTRUCTION THAT KEEPS FLUIDS FLOWING

1 This is one of a stack of *discs,* held apart by

2 *Spacers,* whose thickness determines the degree of filtration.

3 Discs and spacers are mounted on a *central rotatable shaft* which has a handle.

4 Mounted on a stationary rod alongside the shaft are *cleaner blades,* slightly thinner than spacers, extending into the slots between the discs.

5 Fluid containing solids passes between discs, and solids larger than the aperture are retained on the outer edges.

6 Turning the handle rotates the discs past the stationary cleaner blades, combing out accumulated solids, when they fall into the sump, to be drained when convenient.

Here's How

A CUNO FILTER SAVES PRODUCTION LOSS

You save plenty of downtime expense by giving Cuno Filters the job of cleaning out unwanted solids from fluids of all kinds.

The Cuno type of Filter continues to clean while it's *being* cleaned. Turning a handle (manually or mechanically) gets rid of the collected solids—it's as simple as that. Nothing to make the fluid "wait". No filter medium to clean or replace. No duplex installation involving changeover valve, piping and connections.

All types of fluids (including air and gases) are strained clean this non-stop way. "80 Ways to Make More Money" describes some of them. Write today for this free booklet.

CUNO FILTERS KEEP THESE OPERATIONS ON "GO" BY

1. removing lint from viscose rayon dope
2. removing lint, fibre, lumps and grit from paper coating material
3. removing sticks, stones and wood chips from rosin
4. removing sticky residues from ammonia vapors
5. removing solids and lumps from greases as they are pumped from compounding kettles to drums or cans
6. removing oversize lumps of filler from asphalt roofing coatings. If you have a problem straining dirty fluids perhaps a Cuno Filtration Engineer has the answer.

KEEP ON GO WITH CUNO

CUNO ENGINEERING CORPORATION
122 South Vine Street, Meriden, Conn.

Please send me, free, "80 Ways to Make More Money."

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Company .....

Street .....

City ..... State .....

ANNOUNC

ALLIS-CHALMERS *Electrifugal*

ING!

Here Are Engineering Advancements That Mean More Gallons... At Less Cost to You!

1. **All-in-One . . . Motor and Pump Designed as Unit on One Shaft and One Housing . . . Increases Compactness . . . Adds to Flexibility.**

2. **Allis-Chalmers Lo-Maintenance Motor . . . Developed Especially for This Work . . . Gives Maximum Pumping Efficiency at Lowest Power Cost . . . Built with Cast Iron Frame for Special Applications in Chemical Industry.**

3. **Splash-Proof Features . . . with Air Passages Baffled . . . Safeguard Motor from Liquids.**

4. **Fewer Parts to Wear . . . Better Fit to Parts Because of Fewer Machine Joints . . . Adds to Long-Life, Low-Cost Operation.**

5. **Indestructible Rotor . . . Distortionless Stator . . . Bronze Fitted Pump Parts . . . Large Space Provided for Adjusting Glands . . . and Other Features Assure You Improved Performance.**

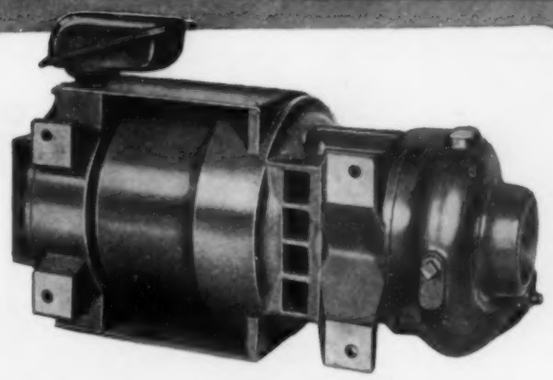
6. **Greater Stability and Rigidity of All-In-One Design . . . Means Less Vibration . . . Lower Maintenance . . . Longer Life.**

THESE ARE ONLY a few of the great features that have been made a part of the new all-in-one Electrifugal Pump by Allis-Chalmers engineers . . . the same trail-blazing engineering that designed and built the gigantic Niagara Falls and Boulder Dam turbines . . . that originated the motor-coupled pump in 1926!

Here, in one unit, is the pump and motor combination you've been looking for . . . modern in appearance . . . ready to give you more gallons per dollar of power cost.

So before you buy . . . get the whole story of the new Allis-Chalmers Electrifugal Pump. Find out how well it fits into your present set-up . . . how it can save you money. Best of all — learn how you get these *extra-value features* at *no* extra cost.

Call the nearest Allis-Chalmers district office . . . or write Allis-Chalmers, Milwaukee . . . today! A-1300



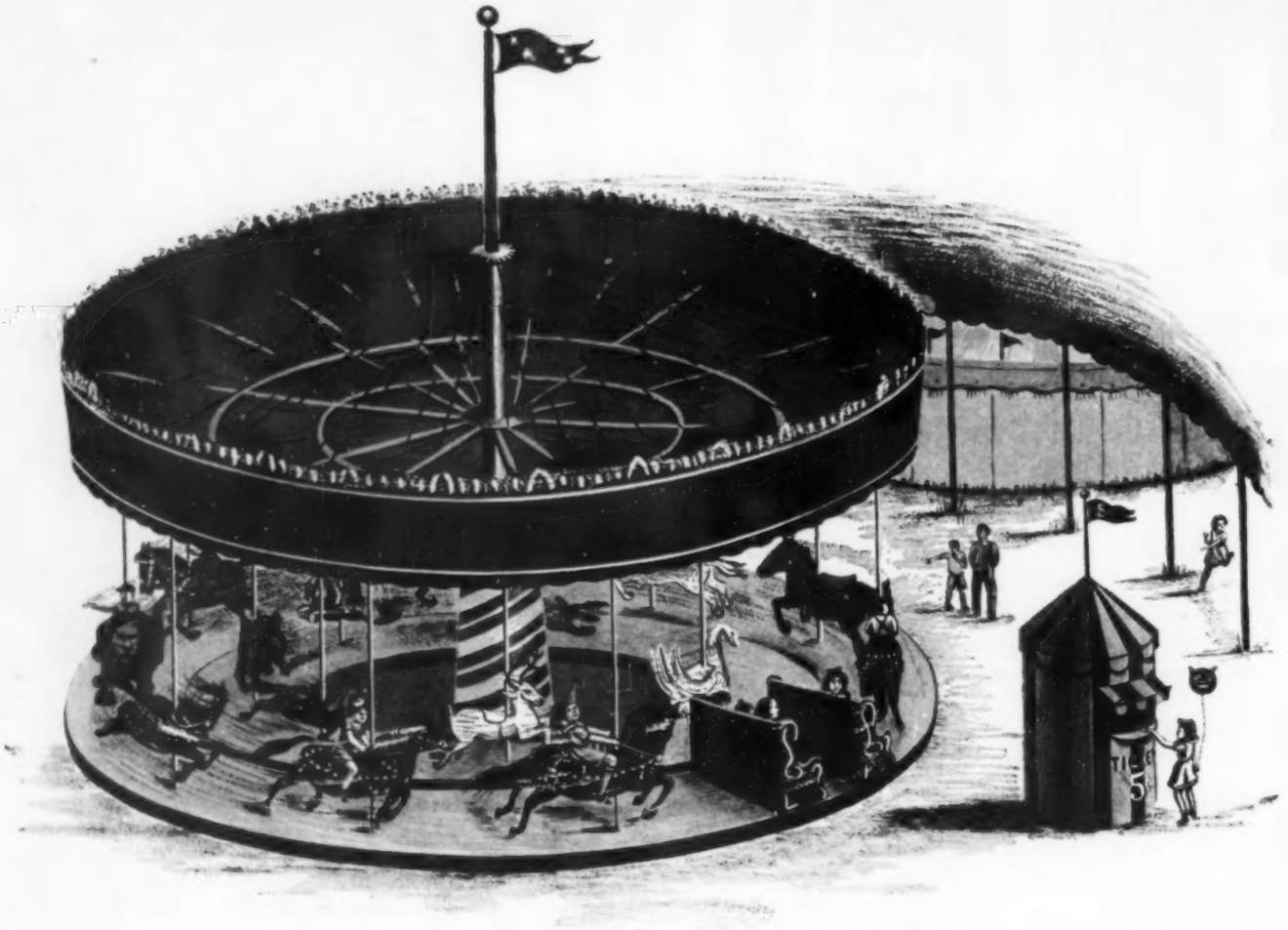
IN THIS UPSIDE-DOWN VIEW OF THE Electrifugal Pump, see how the air goes in and out through large air passages, keeping the motor cool at all times.

THIS DISTORTIONLESS, REMOVABLE Stator is one of the many outstanding features of the Allis-Chalmers Lo-Maintenance Motor used as integral part of the Electrifugal Pump.

INDESTRUCTIBLE ROTOR IS on the same shaft with pump runner — making a single unit of pump and motor . . . with lower maintenance and longer life.

THE ALLIS-CHALMERS ELECTRIFUGAL Pump has bronze runner wear rings, water seal ring, and shaft sleeve . . . has been designed to deliver maximum gallons at minimum cost.

PUMP *Cuts your Pumping Costs!*



A Round-Trip Ticket to Nowhere...

Profitless Processes and Merry-go-rounds have much in common.

There may be much action . . . gaudy trimming . . . blatant music . . . but the rider gets nowhere.

Sharples Centrifugal Processes have a definite objective. They are specially designed and individually applied to *your* job—and the destination is higher quality with lower costs.

It will pay you to let Sharples analyze your problem—test your samples—and recommend the particular Centrifugal Process with the type of Centrifugal that exactly suits your conditions.

Then you will have a "through ticket" to where you want to go.

THE SHARPLES CORPORATION

★ CENTRIFUGAL AND PROCESS ENGINEERS ★

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SEATTLE SAN FRANCISCO LOS ANGELES REPRESENTATIVES THROUGHOUT THE WORLD

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U.S.I. CHEMICAL NEWS

December ★ A Monthly Series for Chemists and Executives of the Solvents and Chemical Consuming Industries ★ 1940

See New Vanadium Source in Western Phosphate Rocks

Economical Recovery Possible By Solvent Extraction Process

LEONIA, N. J.—The phosphate deposits of Wyoming, Utah, Idaho, and Montana offer a source from which vanadium can be economically extracted, it is claimed in a patent granted jointly to inventors here and in New York. Efficiency of the process, it is said, depends on the use of solvents.

Western phosphate rock, it is said, has taken on greater importance as a source of phosphoric acid, as a result of increased demand for the acid in the manufacture of "double" and "triple" superphosphates. It is known that these rocks contain an appreciable amount of vanadium, which appears in the final phosphoric acid solution.

Converted to Pentoxide

The inventors propose to recover the vanadium content by a method that is described as simple and effective. The vanadium content of the acid solution is first converted to the pentoxide form by an oxidizing agent such as potassium persulphate. The vanadium content is then extracted, it is claimed, by the action of a selective solvent. Suitable solvents, according to the inventors, include ethyl ether, isopropyl ether, ethyl acetate,

(*Continued on next page*)

New Coating Makes Paper Moisture- and Odor-proof

WILMINGTON, Del.—A new composition that can be applied to paper in a continuous film makes the paper substantially proof against moisture, odors, and vapors, according to a manufacturer here.

Basis of the coating is said to be a granular white material, made by completely reacting chlorine and pure, pale crepe rubber. It is said that the material is soluble in many common solvents and that it deposits clear films.

For paper coatings, the material is usually mixed with a plasticizer such as dibutyl phthalate, it is reported. Dibutyl phthalate is chosen, according to the manufacturer, because it helps to develop excellent moisture- and vapor-proofness in the finished coating. In addition, it has the advantage of being free from odor.

Dibutyl Phthalate is produced by U.S.I.

Report Ethyl Cellulose Improves Spirit Varnish

LOUISVILLE, Ky.—Moisture resistance, hardness, and abrasion resistance of spirit varnishes can be substantially improved by substituting ethyl cellulose for small percentages of the resin content, it is indicated by investigations carried on here.

Studies were made of pontianak and Manila resins, using a solvent consisting of 75% alcohol and 25% toluene. All qualities investigated showed substantial improvement, it is claimed, when ethyl cellulose was added.

New Acetone Uses Found, Sales Volume Continues on Up Trend

Demand Continues Strong in Existing Fields, Many Additional Markets Seen in Novel Solvent and Raw Material Applications

Uncovery of many novel applications for acetone is combining with continued demand in established fields to maintain sales at a high level for this widely used U.S.I. product. Export markets are up, as well as domestic, and acetone exports for the first half of the current year jumped to 12,128,410 pounds from a figure of 8,159,890 pounds for the same period last year. Many of the newer uses of acetone make use of its solvent properties; in other cases it is employed as a raw material for chemical manufacturing processes.

The rayon industry remains one of the largest users of acetone, and it is estimated that the consumption in rayon and allied fields in 1940 will reach a figure of 32,000 tons. Even in such well established fields as this, new acetone applications are coming to light, and a recent patent described a method for producing rayon yarns of improved extensibility, employing acetone.

Applications in Cellulose Field

Moistureproofing of regenerated cellulose sheets can be effected, it is claimed, by treating the sheets with acetone, which is said to displace existing liquids in the surface layers of the sheets. The sheets are then impregnated with a succinic acid-glycerol resin dissolved in acetone. A process for dyeing cellulose derivatives is said to consist in dissolving them in acetone with a diazogene compound and a coupling component.

Among the established uses of acetone, its application as a solvent for acetylene is a very important one. It is the most economical solvent known for this purpose, dissolving 25 times its own volume at ordinary temperatures and pressures. Other solvent uses include dry cleaning fluids, paint and varnish removers, natural and synthetic resins, bituminous paints, smokeless powder, TNT, artificial leather, lacquers, and dopes. A novel use is in the recovery of copper in the wire drawing process. The oily sludge

(*Continued on next page*)

U.S.I. Widens Its List Of Acetoacet-arylides

U.S.I. announces that the following acetoacet-arylides are now in regular production:

- Acetoacet-anilide
- Acetoacet-ortho-chloranilide
- Acetoacet-ortho-toluidide
- Acetoacet-para-chloranilide
- Acetoacet-ortho-anisidide

Laboratory or pilot plant samples have been prepared of these additional items, which can be made in larger quantities if sufficient demand appears:

- Acetoacet-para-phenetidide
- Benzoylacet-anilide
- Biacetoacetyl-meta-toluylenediamine
- Biacetoacetyl-para-phenylenediamine
- Acetoacet-para-nitroanilide
- Acetoacet-2,5-dichloranilide
- Acetoacetyl-alpha-naphthylamine
- Acetoacet-cumidide (pseudo)
- *N, N'*-Biacetoacetbenzidide

In addition to these products, on which inquiries are invited, U.S.I. is in a position to make laboratory samples of other acetoacet-arylides at the suggestion of prospective customers.

Produces "Synthetic" Hardwood

RIDGEFIELD PARK, N. J.—A product similar to hardwood can be prepared by a process for injecting natural or synthetic resins into green wood, at the same time extracting the sap and moisture, it is reported here.

The "synthetic" hardwood, it is claimed, is resistant to warping, rotting, and fire, and can be produced at lower cost than the natural hardwoods it is intended to replace.

Solvent in the manufacture of artificial textiles, vehicle in liniments—these represent two of the extraordinarily diversified uses of acetone.

ADVERTISEMENT—*This entire page is a paid advertisement.*

December ★ **U.S.I. CHEMICAL NEWS** ★ 1940

Drying Components of Marine Oils Extracted By Ethyl Acetoacetate

MILWAUKEE, Wis.—A novel application for ethyl acetoacetate in extracting the drying constituents of fish oils is revealed in a patent granted to an inventor here.

Ethyl acetoacetate is particularly valuable in refining raw oils such as sardine or menhaden, according to the inventor, because it dissolves most of the unsaturated components which are useful in paints and varnishes, while at the same time it has low solvent powers for the undesirable "break" and color constituents.

Ethyl Acetoacetate is produced by U.S.I.

Acetone Sales Volume Up

(*Continued from previous page*)

resulting in the drawing process is extracted with acetone, it is said, removing the oil and leaving a residue of fine copper powder. A patented plastic wood composition is said to incorporate vinyl resins and acetone.

As a raw material for chemical manufacture, acetone has exceptional potentialities. Benzylidine, bromoform, chlorbutanol, chloracetone, diacetone, chloroform, iodoform, indigo, ionone, isoprene, and mesityl oxide are among the more familiar compounds that can be produced from acetone. Oxidation inhibitors for rubber are commonly prepared by the reaction of acetone with an aromatic amine. A recent patent in this field covers an inhibitor prepared by heating acetone and a *p*-amino-substituted diaryl thio ether in the presence of iodine. A new gum inhibitor for oils and cracked gasoline is described as a reaction product of acetone and pyrocatechol.

Preparation of Bis-phenols

Still other uses for acetone include a process for preparing bis-phenols by treating phenols with acetone in the presence of an inorganic acid; manufacture of ketene and its homologs by pyrolysis of acetone in contact with copper; preparation of fusible resins by treating an aldehyde with acetone in the presence of a catalyst.

In the medical field, acetone is extensively used as a vehicle for liniments and in the treatment of purulent wounds. This, of course, is in addition to the medical use of many of the compounds already mentioned, in which acetone is used as a raw material.

As a leading producer of solvents, U.S.I. supplies acetone of the highest quality for these diversified requirements.

Here's Pleasant News For Cigarette Smokers

SOUTH ORANGE, N. J.—No loose shreds of tobacco will find their way into your mouth if the end of your cigarette is impregnated with a solution of ethyl cellulose in anhydrous ethyl alcohol, it is claimed by an inventor here. The solution, it is said, stiffens and waterproofs the paper at the mouth end of the cigarette, and binds the tobacco shreds together so that they do not become loose.

The inventor also claims that the composition is non-toxic and has absolutely no effect on the taste or odor of the smoke. Best news of all is the claim that absent-mindedly lighting the wrong end produces no ill effects.

U.S.I. is a leading producer of Anhydrous Ethyl Alcohol.

Claims Pipe Seal Immune To Alcohol, Oils, Steam

BROOKLYN, N. Y.—Use of blown castor oil, produced by oxidizing or polymerizing raw castor oil, is desirable in packing and sealing compounds exposed to heat, vibration, and chemicals, it is claimed in a patent granted to an inventor here.

The blown castor oil, the inventor claims, is substantially insoluble in gasoline, gasoline-alcohol mixtures, fuel oils, and alcohol-containing preparations, such as anti-freeze. Moreover, it is said that the seal is not affected by heat, hot water, or steam.

A typical composition is said to have the following proportions:

Philippine gum	6 lbs.
Ethyl alcohol	1 gal.
Blown castor oil	1½ gal.
Talc	25 lbs.

Vanadium Recovery Process

(*Continued from previous page*)

butyl acetate, and a number of other organic compounds.

Several methods have been proposed for recovering the metal values from the organic solution. For example, it is said that the solution may be brought in contact with water, allowing a certain quantity of the metal value to pass into the aqueous phase. The vanadium in the water phase can then be reduced to the tetravalent state, in which it is largely insoluble in the organic solvent, and the water phase can be recycled.

Ethyl Ether, Ethyl Acetate, and Butyl Acetate are produced by U.S.I.

TECHNICAL DEVELOPMENTS

Further information on these items may be obtained by writing to U.S.I.

New rust preventives are said to incorporate an ingredient that provides a homogeneous, noncrystalline film, with a high degree of cohesion and adhesion to metal. It is reported that products can be supplied to meet industrial specifications. **(No. 400)**

U S I

A transparent floor finish is unaffected by extreme conditions of acidity or alkalinity, according to the maker. It is claimed that dried films of the product have been immersed in dilute sulphuric acid, carbolic acid, and sodium hydroxide solutions without damage to finish or gloss. **(No. 401)**

U S I

Fugitive tints for identifying cotton, viscose, and acetate staple fibers are described as oil-soluble dye concentrates to be added to the oil used in conditioning cut staple fibers. Eight colors are said to be available. **(No. 402)**

U S I

Sodium chlorite is said to be strong enough to bleach cotton, rayon, wood pulp and other cellulose fibers, without attacking the fibers themselves. It is claimed that the sodium chlorite will bleach in both acid and alkaline solutions. **(No. 403)**

U S I

Textile colors can be applied directly to cotton, rayon, acetate, and other fabrics by standard textile printing machinery, and require no after-treatment, it is claimed. It is said that the colors have excellent fastness to light and to repeated washings. **(No. 404)**

U S I

A mildew preventive is said to be especially designed for incorporation in paints and plastic materials to prevent the growth of mold, mildew, spores, and algae. It is also claimed that the product promotes even spreading, increases adhesion and flexibility of paint film. **(No. 405)**

U S I

A new ink that is said to be especially suitable for laundry marking is described as resistant to soap, lye, bleaching fluid, and oxalic acid. **(No. 406)**

U S I

Stable emulsions of mineral oil, pine, oil, toluol, and other oils and waxes, containing as high as 6% hydrochloric acid and other strong electrolytes, have been prepared with the aid of a new emulsifying agent, it is claimed. Applications are said to include paper, leather, textile, and cosmetic industries. **(No. 407)**

U S I

Water-treating equipment is said to have been developed for removing carbon dioxide from water that has been treated in carbonaceous hydrogen zeolite softeners. It is claimed that the treatment also oxidizes any soluble iron present, so that it can be filtered out. **(No. 408)**

U S I

A deep black finish can be produced on steel by a new low-temperature process, it is claimed. It is said that the dimensions of treated parts remain unchanged, and that the finish is resistant to rust and wear. It is also reported that temperatures used are not high enough to affect heat-treated parts. **(No. 409)**

U.S.I. INDUSTRIAL CHEMICALS, INC.

60 EAST 42ND ST., N.Y. (U.S.I.) BRANCHES IN ALL PRINCIPAL CITIES

A SUBSIDIARY OF U. S. INDUSTRIAL ALCOHOL CO.

ALCOHOLS
Amyl Alcohol
Butyl Alcohol
Fusel Oil—Refined
Methanol

Ethyl Alcohol
Anhydrous
Absolute
C. P. 96%
Pure (190 proof)
Specially Denatured
Completely Denatured
U. S. I. (Denatured Alcohol Anti-freeze)
*Super Pyro Anti-freeze
*Solox Proprietary Solvent

*ANSOLS
Ansol M
Ansol PR

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Acetic Ether
Amyl Acetate
Butyl Acetate
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Diethyl Phthalate
Dimethyl Phthalate

OTHER ESTERS
Amyl Propionate
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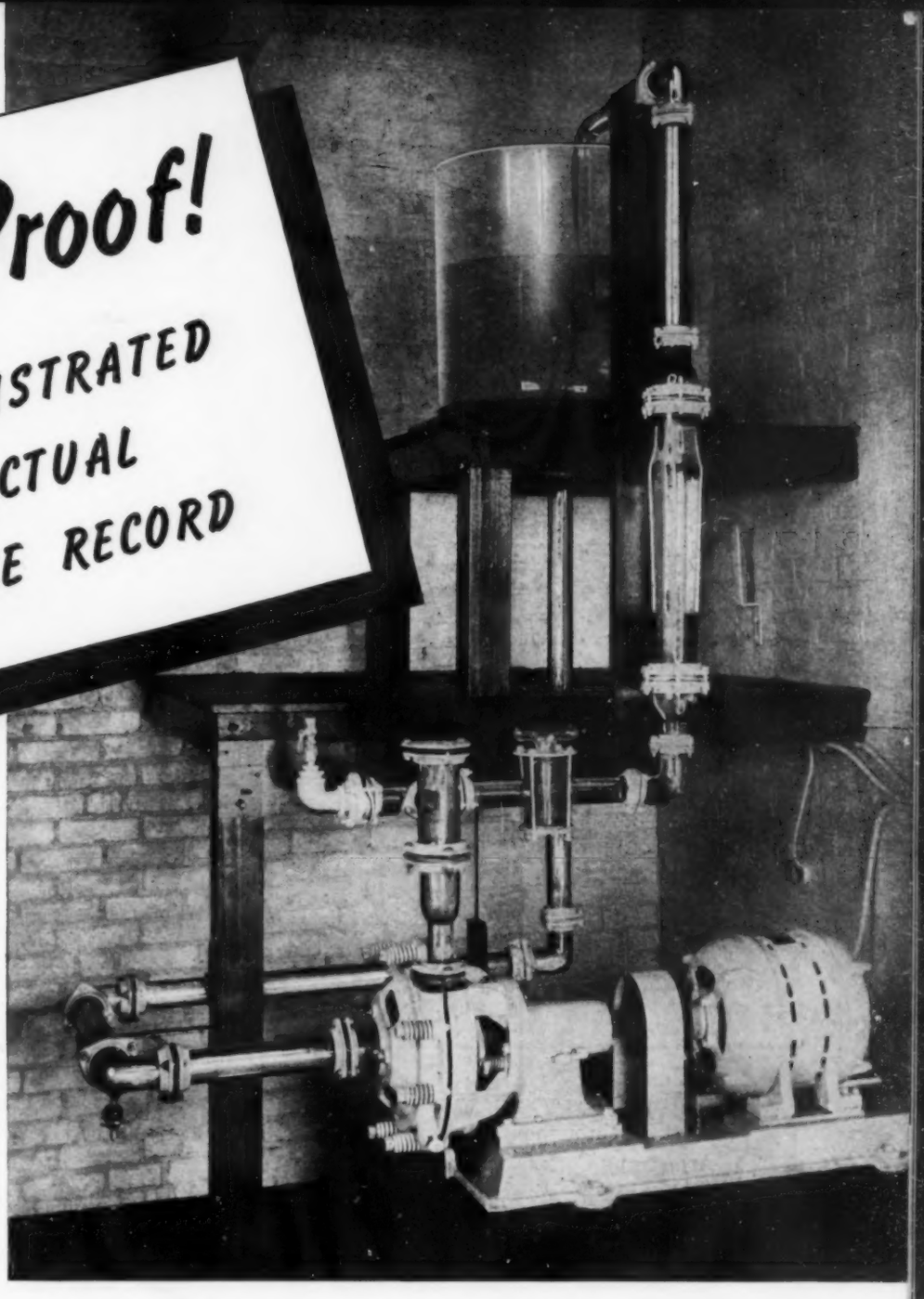
INTERMEDIATES
Acetoacetanilid
Acetoacet-o-chloranilid
Acetoacet-o-toluidid
Ethyl Acetoacetate
Sodium Ethyl Oxalacetate

ETHERS
Ethyl Ether
Ethyl Ether Absolute—A.C.S.

OTHER PRODUCTS
Acetone, C.P.
Collodions
*Curbay Binders
*Curbay X (Powder)
Derex
Ethylene
Methyl Acetone
Nitrocellulose Solutions
Potash, Agricultural
*Vacatone
*Curbay B-G

Corrosion Proof!

VIVIDLY DEMONSTRATED BY THIS ACTUAL PERFORMANCE RECORD



THIS "PYREX" Glass Pump* was put to work pumping 20° Baumé hydrochloric acid at 110° F. through "PYREX" brand Industrial Glass Piping. After 15,000,000 gallons had been pumped, a thorough check-up on the equipment failed to reveal any measurable wear on either the pump or the piping! Both were ready to go on performing under these corrosive conditions indefinitely.

That is a factual example of the remarkable resistance of "PYREX" brand Industrial Glass to all acids in solution (except concentrated HF). It clearly demonstrates the type of corrosion resisting performance you can expect from "PYREX" equipment *in your plant.*

Corning Engineers will gladly cooperate with you in the solution of your corrosion problems. Write to them. Corning Glass Works, Corning, N. Y.

A photograph of the set-up at Nash Engineering Co. where these performance records were obtained.

*The "PYREX" Glass Pump, developed by Nash Engineering Co. and Corning Glass Works, is sold through Nash Engineering Co., South Norwalk, Conn.

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works.

CORNING
Glass Works
Corning, New York

Pyrex Industrial Glass

Powell Pioneering

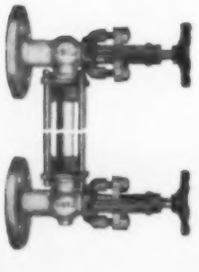
• • • PLUS THE USE OF PURE NICKEL ALLOYS, LIKE MONEL ETC. • • • WHICH GUARANTEES LOW-COST CORROSIVE

"Quality . . . through and through" is a phrase used all to freely in the selling of goods of every description. Occasionally, however, inherent, underlying quality can be so clearly demonstrated that a claim of this nature is thoroughly justified. Take Powell Corrosion Resistant Valves, for instance!

As pioneers in the field, Powell first offers the buyer extra years of experience in the development of new designs and manufacturing techniques particularly suited to the unusual physical characteristics of the special metals that would have to be employed. Then, through selection of only the finest of such metals, like INCO Pure Nickel, Monel Metal, and the

POWELL VALVES

THE WM. POWELL CO. • CINCINNATI, OHIO

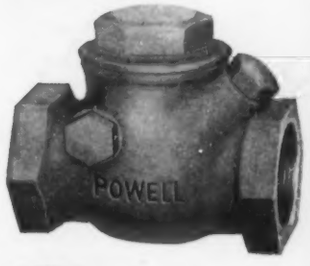


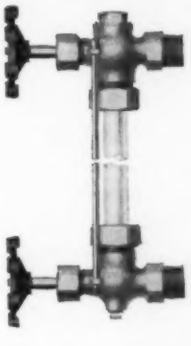
NICKEL AND METAL, INCONEL, MAXIMUM, SERVICE!

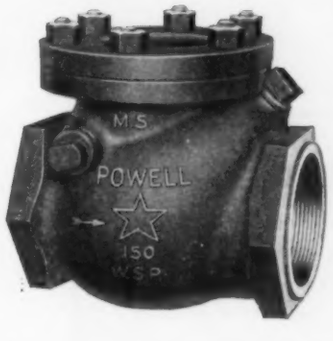
many nickel alloys specially developed by International Nickel Company engineers for maximum resistance to acids, high temperatures, and the corrosive and erosive action of gases and superheated steam, Powell Valves literally *are* quality . . . "through and through."

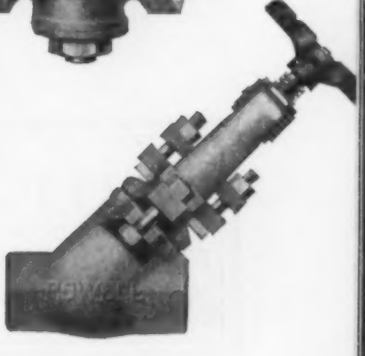
Be sure, therefore, when specifying special valves for the severest, as well as the more normal, corrosive services to be found in the chemical and processing industries, that you take advantage of the better performance and greater economy assured by this combination of longer experience and finer materials. You'll find Powell Monel Metal, Pure Nickel and other nickel alloy Valves available in types and sizes to fill every requirement (only a few are illustrated on these pages) . . . or Powell engineers will gladly consult with you in the solution of any special problem you may encounter.

You Need More Than a Photograph of the Finished Product to See All the Qualities Necessary for Lowest Cost Corrosive Service.









A NEW TOOL FOR CHEMICAL PROCESSING

Overhead View of The Agitair

• The AGITAIR FLOTATION MACHINE is practically engineered for smooth even agitation resulting in finely disseminated air bubbles to give maximum recoveries.

Positive individual cell control assists in regulation of desired operation for each cell.

The AGITAIR is designed for flexibility in installation.

The exclusive cone shaped impeller, the heart of the machine, produces the agitation and aeration and allows the Agitair to start up after temporary shutdown without draining the cells.

In actual competitive commercial tests The Agitair has proven its superiority.

• A new valuable tool for the chemical engineer is being realized in froth flotation and similar forms of levitation such as film flotation or floccule separation from inflocculated materials.

The Chemical Process Industries are rapidly expanding to this field for fractionation of purification of chemical raw materials and for numerous other separations. Natural hydro carbons, ceramic raw materials, resins and mixtures of salts are barely a beginning in the possible adaptations of levitative methods.

Fractional crystallization and long tedious evaporation has been quite common in past separations of salt mixtures. This example, from among many, is of definite interest to the chemical engineer in that froth flotation effects far from a "rough" separation and is done very simply with just a convenient frother. In this manner, the fatty acids, after activation with small amounts of lead chloride, will selectively film sodium chloride whereas naturally mixed ores will readily film only the potassium chloride by some of the sulphated aliphatic alcohol salts. The potassium chloride is then quite satisfactory for use as a fertilizer. All this certainly means great savings!

Such savings may be realized by you through an adaptation of AGITAIR Flotation separation in your plant. Why not write today for further information regarding an application to your separation problem. Address Dept. A-8.

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BOOTH-THOMPSON DIVISION
228 South West Temple, Salt Lake City, Utah
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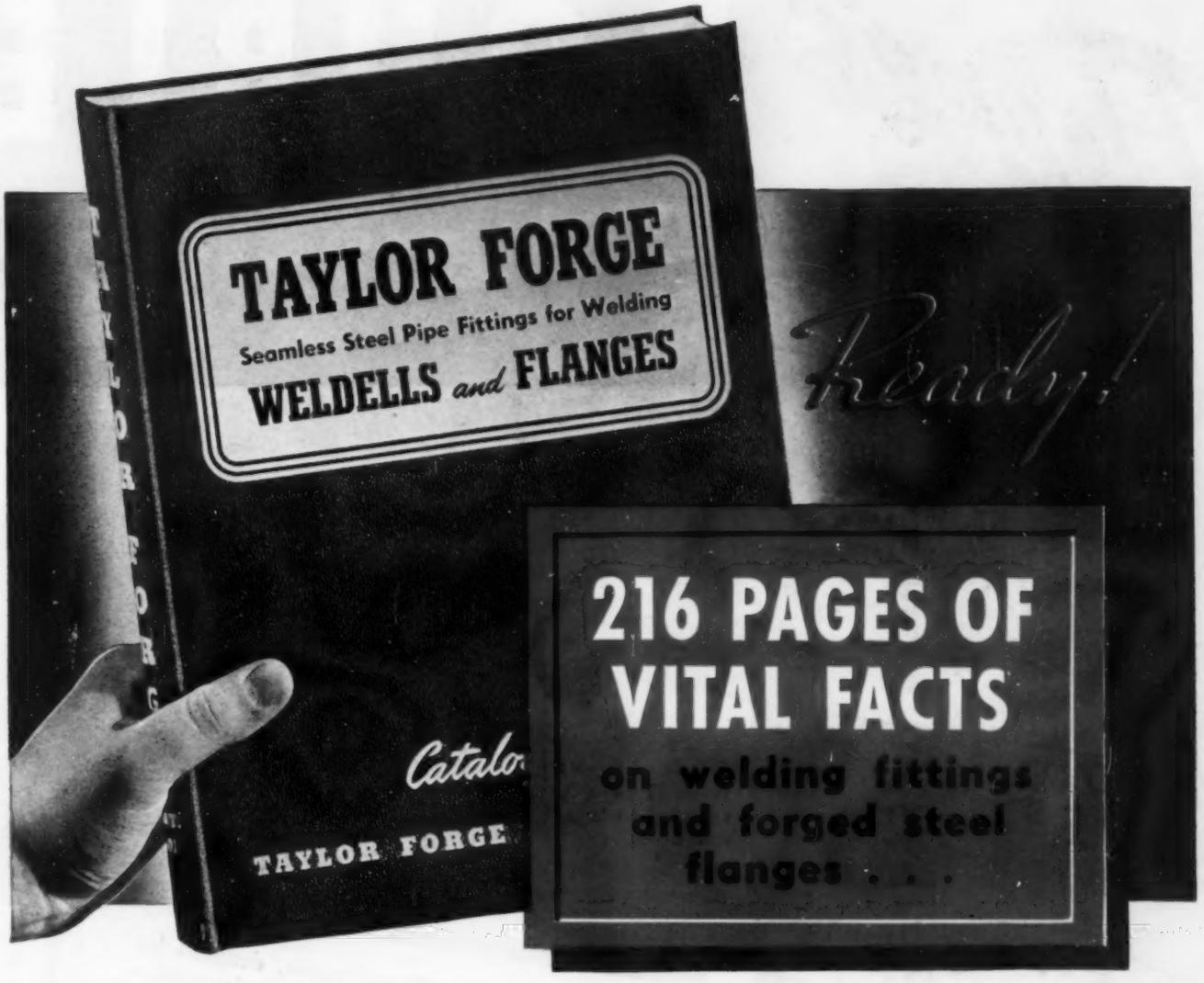
THE BRITISH MINING SUPPLY (PTY.) LTD.,
Johannesburg, South Africa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216 PAGES OF VITAL FACTS
on welding fittings and forged steel flanges . . .
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HERE in a permanent, cloth-bound volume you have the most exhaustive and useable treatise ever published on the application of welding fittings and forged steel flanges.

Beyond the particularly complete and clear dimensional and price data covering Taylor Forge WeldELLS and Forged Steel flanges, its 216 pages contain engineering data that will prove invaluable to the man who purchases, designs or specifies piping, fittings and flanges in carbon and alloy steels.

Among the subjects presented are case studies of flexibility in welded piping, comparisons of theoretical with test results, flange bolting data, complete data on standards, pressure and temperature ratings, sub-normal impact testing data—in fact, far more information on welding fitting and flange application than was ever before published in one volume.

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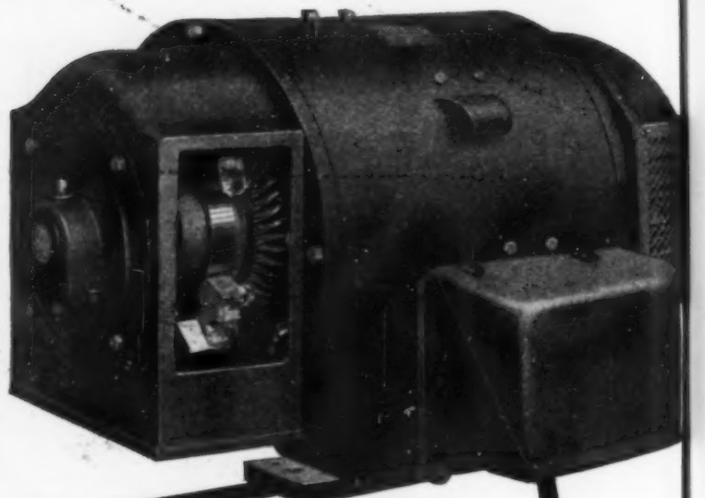
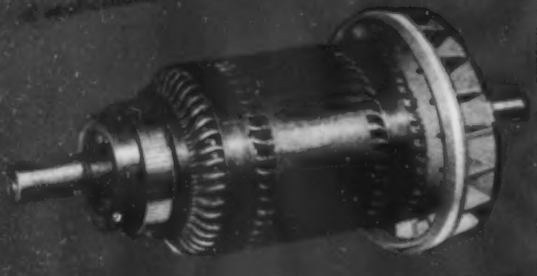
There's DOUBLE in the NEW FEATURES

G-E direct-current motor, Type CD, typical of the larger ratings.



An improved ventilating system, designed for reversible rotation, gives positive axial ventilation through the motor.



Armature is dynamically balanced, welded and fingers hold laminations tight. Radial ducts in punchings, and openings in the 4-arm spider that holds them, provide positive ventilation.

The same bearing bracket is used for ball and sleeve bearings, and the bearings can be removed without disturbing brush-rigging connections.

The larger motors have a new "V-type" brush holder designed for reversing service.

Split construction of the highly efficient fan scroll, which forms the drive-end bearing bracket, allows the scroll to be removed easily.

The radial-blade fan is cast-aluminum and specially designed for use in reversing service. The fan is rabbetted and bolted to the armature spider.

PROTECTION

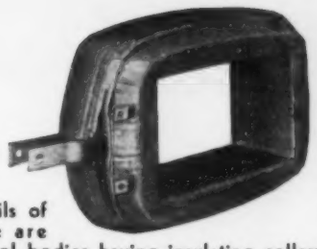
of G-E Direct-current Motors

Exposed Parts Protected against External Damage

The over-all design of the open motor makes it readily adaptable for use even on jobs that have natural hazards to motor life. It not only safeguards the motor parts, but also increases safety for workmen.

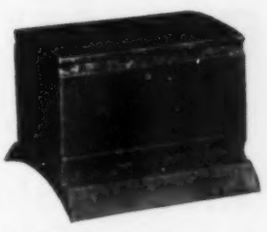
Protected Internally against Electrical Failure

Electrical protection is gained through the use of Formex magnet wire in the armatures and field coils, and by a final treatment of a specially developed Glyptal base insulating varnish which gives additional value to the other fine insulating materials used.



Main field coils of Formex wire are wound on spool bodies having insulating collars that insulate coil and pole from frame. Each coil is taped, dipped, and baked. A completed coil is shown above.

OTHER new features of G-E d-c motors include such improvements as cast-aluminum fans specially designed for reversing service; reversal without changing any part of the frame, fan, or brush rigging; compact assembly; more positive ventilation; lower WR^2; small diameter, which means low headroom needed; and interchangeability of ball- and sleeve-bearing brackets on the larger motors.



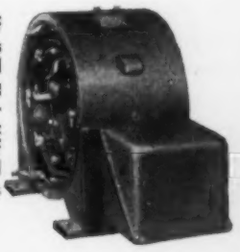
Main field pole pieces are laminated silicon steel, welded together and securely bolted to rolled-steel frame.

These and additional features which all sum up to increased all-round performance and protection are rolled-steel frames, V-type brush holders, cast-brass brush-holder boxes, accurately centered rabbet fit of precision machining, extra large conduit box, provision for lubricating and flushing of bearing while motor is running, punched commutator segments, Textolite wedges in armature slots for winding protection, and constant air gap.

All current-carrying parts and rotating parts, except shaft extensions, can be enclosed readily for protection of operators.

Commutating coils are made of edgewise-wound copper strip with enamel turn insulation, and are insulated from the pole by a layer of laminated acetate paper.

Surely you will want to learn more about motors with such outstanding improvements. These G-E direct-current motors are being applied in increasing numbers on jobs for which standard designs formerly were not recommended. They are fully fitted to fill the bill on your jobs. Call our local office. General Electric Company, Schenectady, N.Y.



Continuous rabbet fit of rolled-steel frame assures accurate concentricity and alignment of the bearing bracket. Additional insulation protects the basic dielectric strength of Formex wire, and red Glyptal varnish protects the coils.

GENERAL ELECTRIC

"They Just Don't Break!"

. . . . that's what users say about these Galvanometer Suspensions!

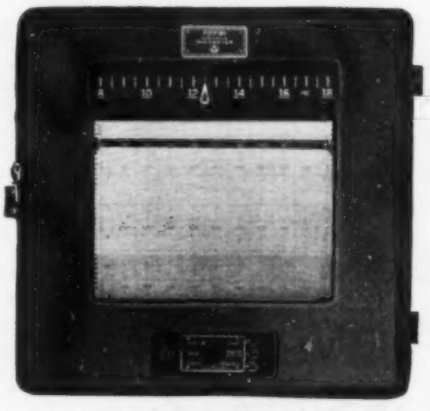
Did you ever see a year or more pass without a single galvanometer suspension replacement in a bank of operating pyrometers?

Several large-scale users of Foxboro Potentiometer Recorders and Controllers have reported this experience. They told us not to bother sending spare suspensions with new instruments on order!

Foxboro galvanometer suspensions are so designed that breakage practically never occurs. Their acid-proof gold strips are longer, heavier, stronger . . . spot-welded, instead of soldered in place. And their end-brackets are made with smoothly-crowned snubbing surfaces that stop destructive shear action.

Yet this is only one of numerous refinements that make Foxboro Potentiometer Instruments more sensitive and more economical to maintain. Other original Foxboro features make possible instant, accurate response with *slower* movement of elements and *fewer* moving parts to wear out!

Get the complete story on these trouble-free instruments. Write for Bulletin 190-4. **The Foxboro Co., 16 Neponset Ave., Foxboro, Mass., U. S. A.** Branches in principal cities of United States and Canada.



Foxboro Potentiometer Recorders and Recording Controllers are guaranteed accurate within ¼ of 1% of scale range.

— RECORDING · CONTROLLING · INDICATING —

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Potentiometer Instruments

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...play an important role in all of these primary Industries

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76% Caustic Soda
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Industrial Alkali
HiTest Alkali
Nos. 1, 2, 3
Alkali Special
B. B. Alkali

DRY CLEANING
Carbon Tetrachloride
Diamond Dry Cleaner

FOOD PRODUCTS
Bicarbonate of Soda
58% Soda Ash
Cleansers

LEATHER TANNING
58% Soda Ash
Bicarbonate of Soda
Bichromate of Soda
Tanner's Alkali

GLASS
58% Soda Ash, Dense
Potassium Carbonate
Non-Fer-Al Lime
Bichromate of Soda
Silicate of Soda

CHEMICAL
58% Soda Ash
76% Caustic Soda
Liquid Chlorine
Bichromate of Soda
Bichromate of Potash

LAUNDRY
Sodium Orthosilicate
Sodium Metasilicate
Supersilicate
Alkalate
58% Soda Ash
Compound No. 5

HOTEL AND RESTAURANT
Diamond Soda Crystals
Cleaner and Cleanser
Compound No. 3
Compound No. 5
Diamond Detergent

OIL REFINING
76% Caustic Soda
58% Soda Ash
Liquid Chlorine

RAYON
76% Caustic Soda
(Rayon Grade)
58% Soda Ash
Liquid Chlorine

MILLING
Bicarbonate of Soda
(Free-Flowing—Special
for Milling Trade)
Liquid Chlorine

PAPER
58% Soda Ash
76% Caustic Soda
Liquid Chlorine
Calcium Carbonate
Silicate of Soda

SOAP
76% Caustic Soda
58% Soda Ash
Diamond Soda Crystals
Silicate of Soda

DAIRY
58% Soda Ash
Cleaner and Cleanser
Diamond Soda Crystals
76% Caustic Soda
Industrial Alkali

METAL INDUSTRIES
58% Soda Ash
76% Caustic Soda
Sodium Orthosilicate

PAINT
Pigments and Fillers
Bichromate of Soda
76% Caustic Soda
58% Soda Ash

TEXTILE
58% Soda Ash
76% Caustic Soda
Silicate of Soda
Metasilicate of Soda
Bichromate of Soda

MUNICIPAL
58% Soda Ash
76% Caustic Soda
Liquid Chlorine
Ferric Chloride
Silicate of Soda

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ELECTRICAL PRECIPITATION

universally recognized as a
standard method of removing

DUST, FLY ASH, FUME, MIST & FOG
***from* GASES**

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The facilities of the organization that has made this name great are available to you on call. Fairbanks, Morse & Co., Dept. 14, 600 South Michigan Avenue, Chicago, Illinois. Branches and service stations throughout the United States and Canada.

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WATER SYSTEMS
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FARM EQUIPMENT
STOKERS
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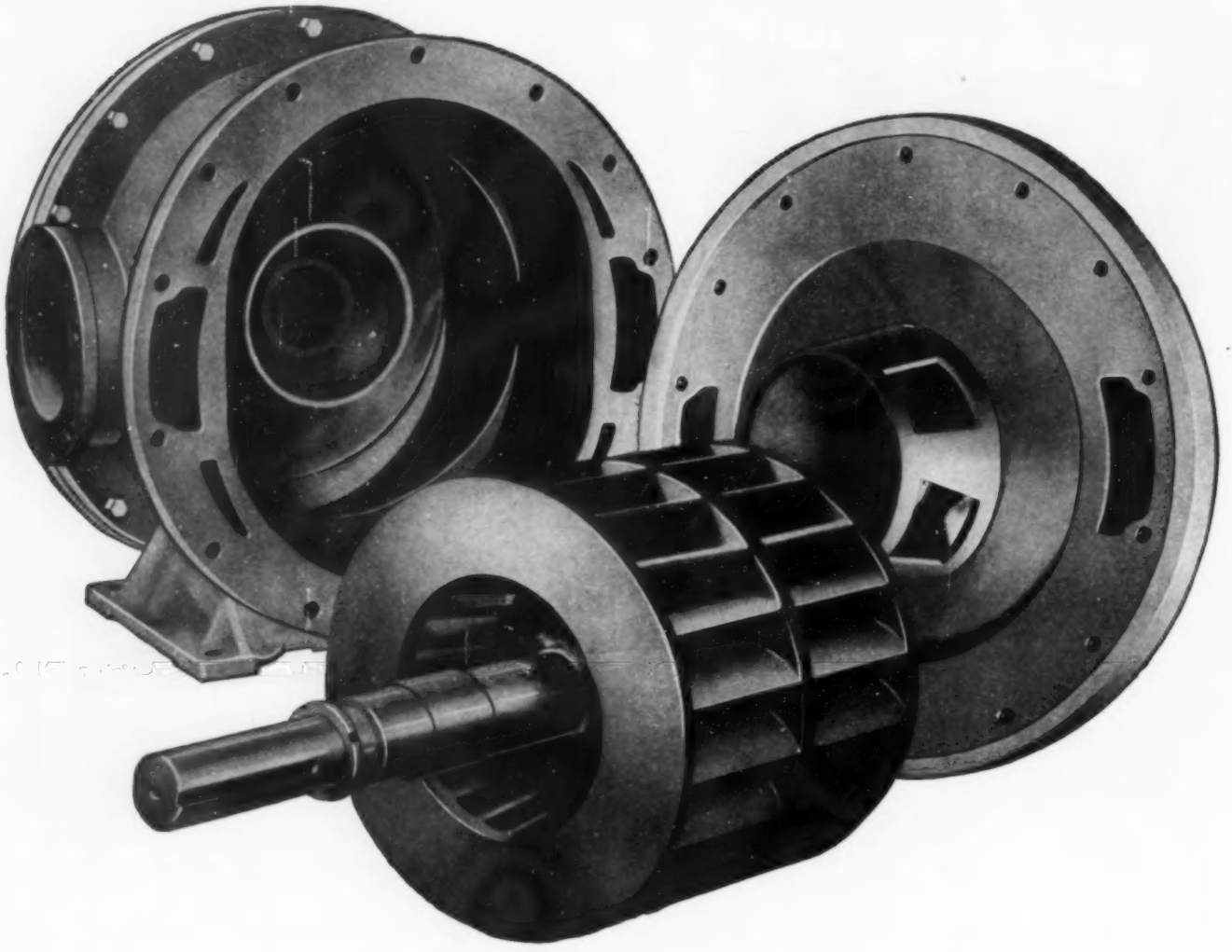
Scales

Only *Nash Vacuum Pumps* have all of these advantages



Nash Vacuum Pumps are simple, having but one moving part. These pumps have unusual characteristics. They will handle a gas and a liquid simultaneously. Slugs of liquid entering a Nash Vacuum Pump do no harm. Thousands are rendering service where this condition is present.

A unique feature of Nash Vacuum Pumps is that, in handling hot and saturated vapors, they have a condensing effect . . . The operating principle involves an internal liquid seal, which condenses and contracts hot vapors and gases . . . Unless the amount of hot vapor is great, other condensing devices are not necessary.

This liquid seal may be varied with the gas being pumped. On solvent work the percentage of recovery may be increased by using a suitable liquid as the pump seal and recirculating this liquid. Because of the complete lack of internal lubrication, the solvent cannot become contaminated.

Nash Vacuum Pumps are furnished in a wide range of capacities up to 5,000 cubic feet per minute. In single stage design they efficiently maintain vacuums up to 27 inches of mercury, and in two stage design vacuums above 29 inches.

THE NASH ENGINEERING COMPANY

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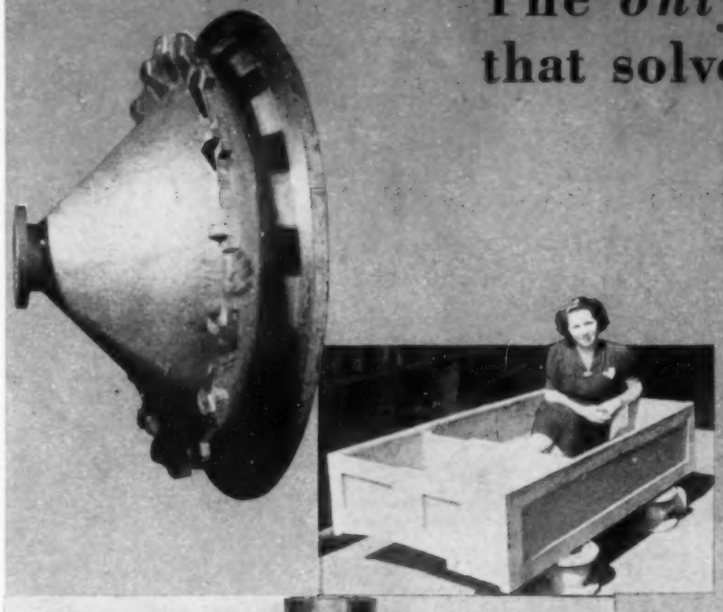
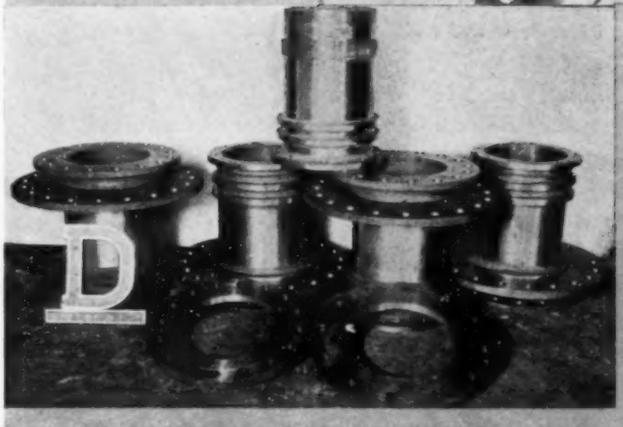
DURIMET

(U. S. Patent No. 2,134,670)





The *only* Stainless Steel that solved these problems!

In a cellulose acetate plant, the acetic and sulfuric acids are hard to handle. This cone bottom, made of DURIMET, has successfully solved the problem and protected the purity of the solutions.

In a metal fabrication plant, oxidizing agents such as iron sulfate, copper sulfate, nitric acid, had stopped pickling operations. This tank of DURIMET for continuous pickling operations, because of its corrosion resistance, tensile strength and general adaptability, solved the problem of production.

In a pulp plant, hot and cold sulfite liquors as well as sulfuric and sulfurous acids were badly corroding certain equipment. These digester sleeves of DURIMET, furnished completely machined, are proving eminently satisfactory.

A refiner and manufacturer of sodium chloride solved his problem of *alkaline* corrosion at all temperatures by using DURIMET fittings.

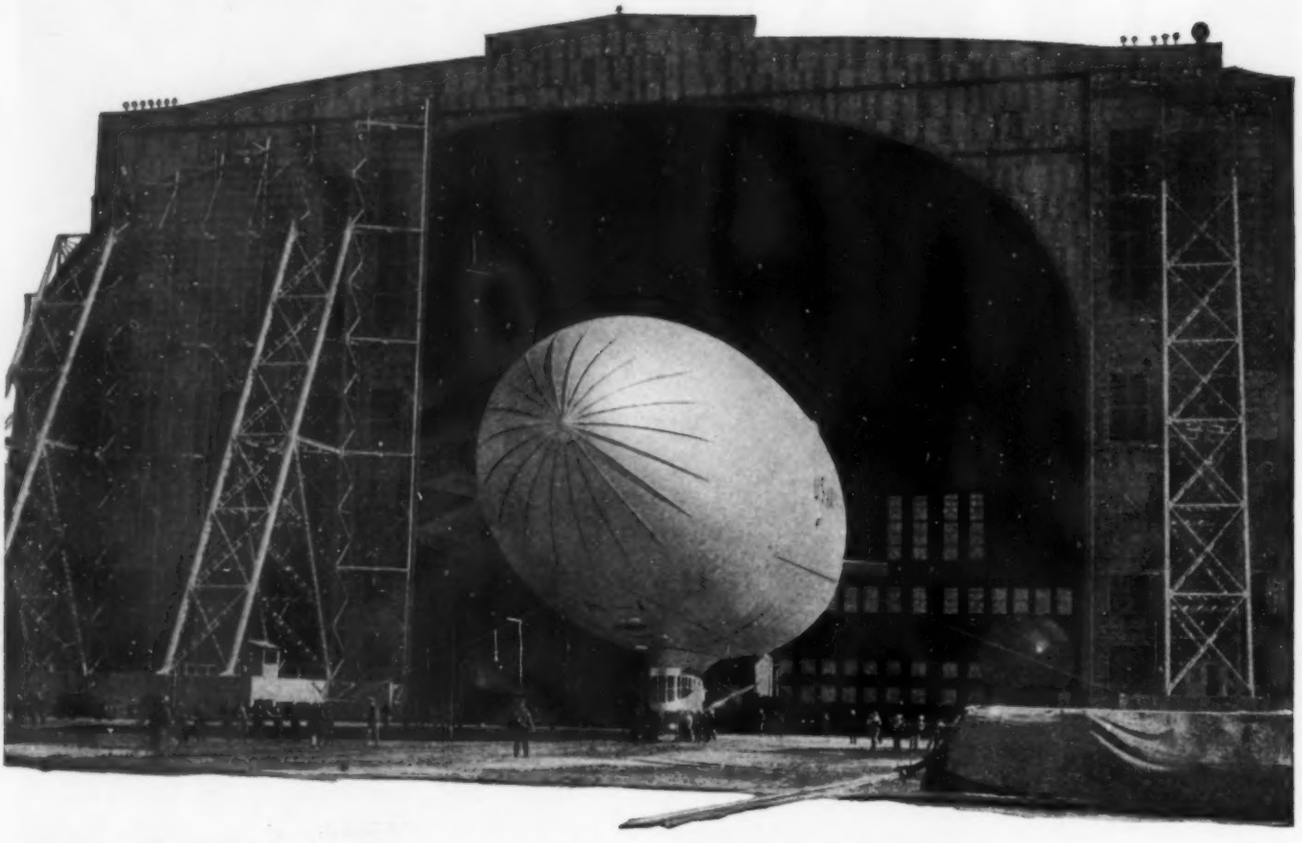
DURIMET may be the answer to some of *your* corrosion problems. It is well worth the time it takes to find out. Write us today—let us tell you what DURIMET has done in similar cases.

STAINLESS STEEL DIVISION

of

THE DURIRON COMPANY, INC., DAYTON, OHIO

K&M CORRUGATED ASBESTOS HAS GIVEN 20 YEARS OF MAINTENANCE-FREE SERVICE ON U. S. NAVAL HANGAR



Official U. S. NAVY PHOTOGRAPH

The camouflaged appearance of this hangar is produced by inherently colored K&M sheets, available on special order.

● All industrialists know the value of maintenance-free buildings. Here is one so big that no less than 40 freight cars were needed to haul the Keasbey & Mattison Corrugated Asbestos used for its walls. It is the hangar at the Lakehurst Naval Air Station.

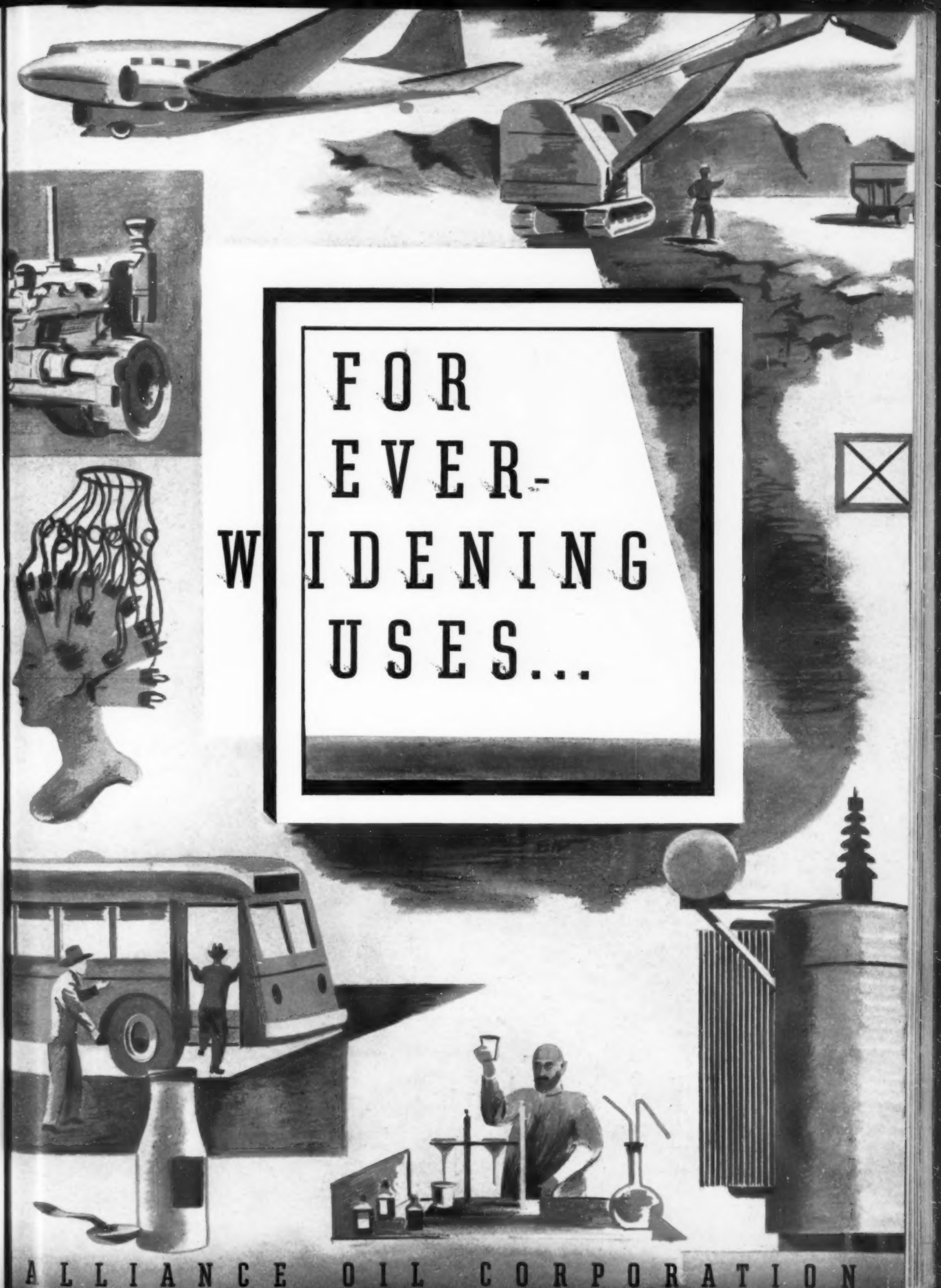
Throughout the twenty years of its existence, this 40-carload expanse of K&M "Century" Corrugated Asbestos has needed no maintenance whatever. Not far from the seacoast, it is exposed to the severest weather conditions, including moisture inside as well as out. It has never needed paint for protection.

This is the kind of economical, maintenance-free service you can expect from "Century" Corrugated on any type of building you may erect. Made of enduring asbestos-cement by Keasbey & Mattison methods, it is fire- and weather-resisting, rust-proof and rot-proof. Why not let "Century" Corrugated cut down your own building maintenance cost? Write Dept. 05 for complete catalogue information.

K&M *"Century"* CORRUGATED ASBESTOS

KEASBEY & MATTISON

COMPANY, AMBLER, PENNSYLVANIA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USES...
ALLIANCE OIL CORPORATION

...to Cosmetics!

EVEN we who market petroleum never cease to marvel at its amazing versatility.

It would seem almost enough for any product to give us light, power, heat, lubricants, a whole array of bright new plastics, synthetic rubbers, all sorts of waxes and countless pharmaceuticals.

But these are only the commonly known uses of oil. For the magic of science converts this treasure of the earth into ever-widening uses...into oils so delicate for beauty...and oils so tough for industry.

With the growth of petroleum for this variety of uses, the name Alliance is climbing into prominence. Its vast knowledge of oils, its ability to select oils with correct characteristics for each manufacturer's requirements, its dependability for purity and uniformity...have led company after company, who want to reap the riches and economies of petroleum, to turn to Alliance.

ALLIANCE OIL C

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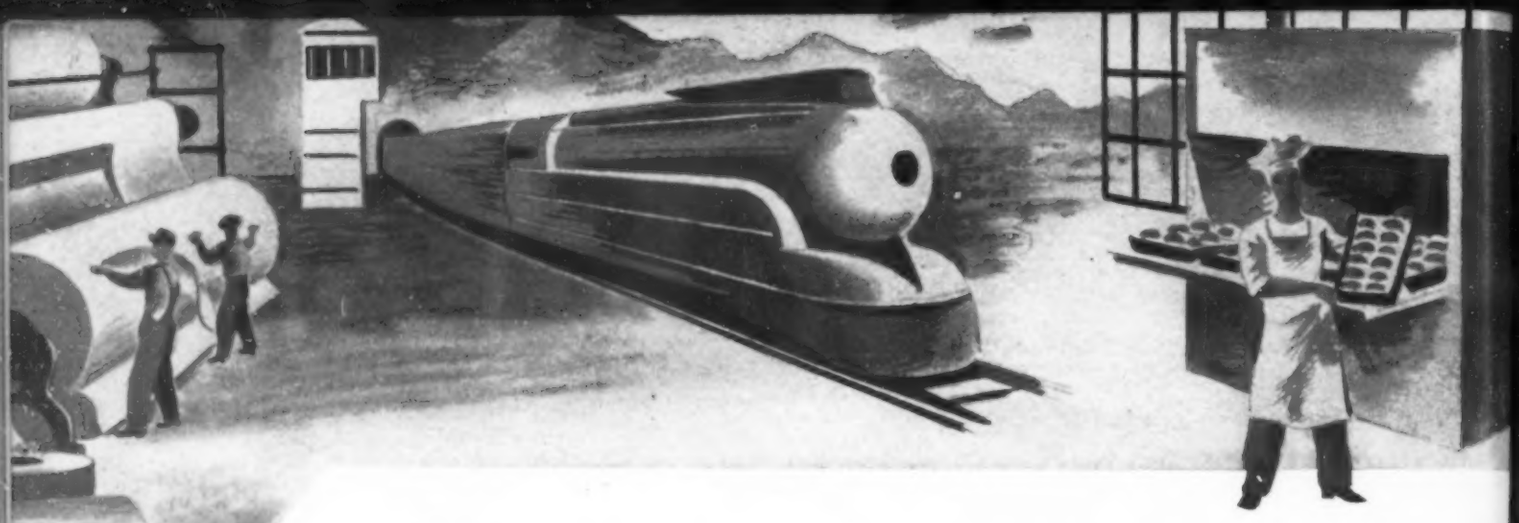


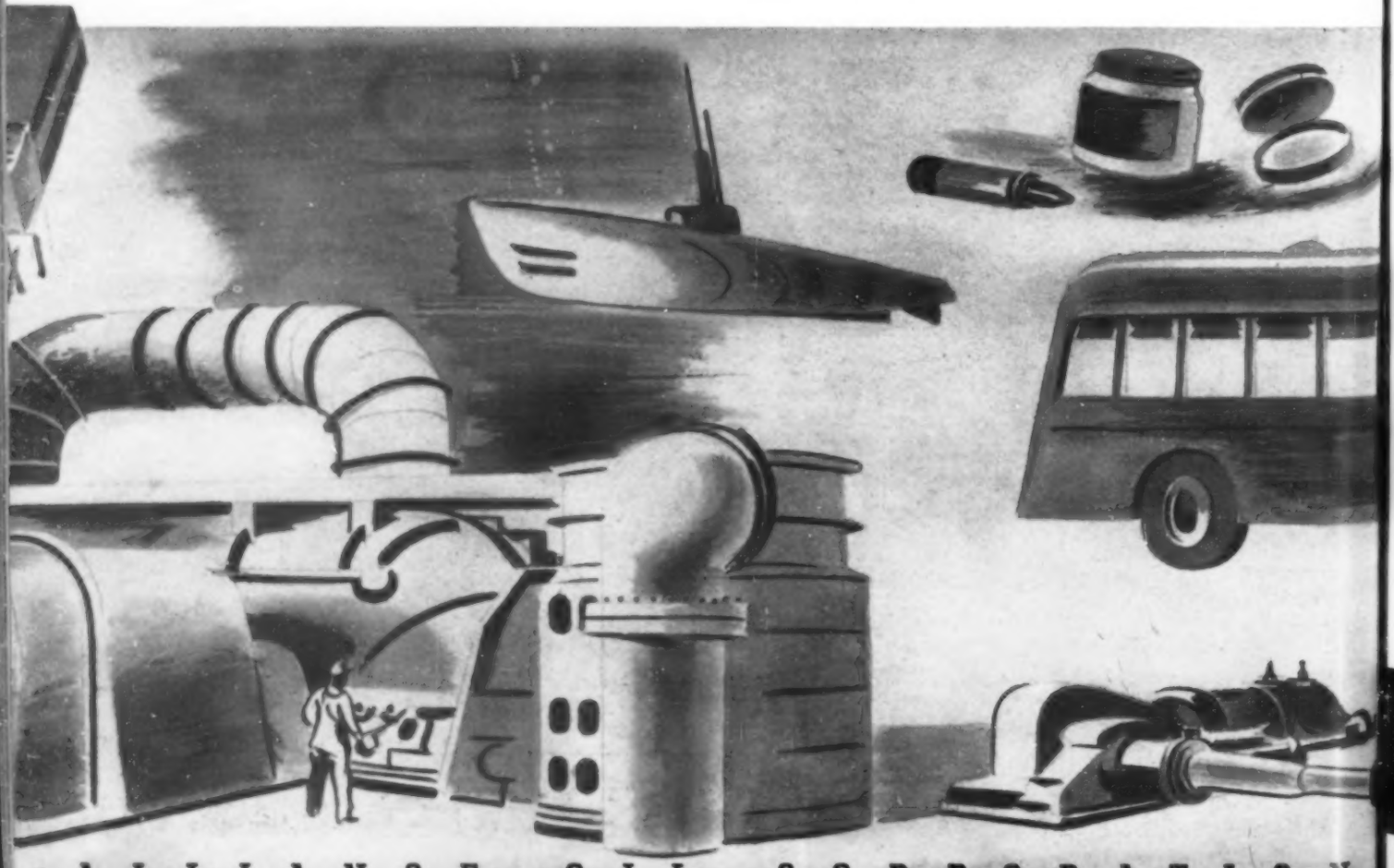
AVIATION OILS • AUTOMOBILE OILS

TRANSFORMER OILS • MEDICINAL OILS

TURBINE OILS • RAILROAD OILS • WAXES

DIESEL OILS • TRACTOR OILS • PETROLATUMS

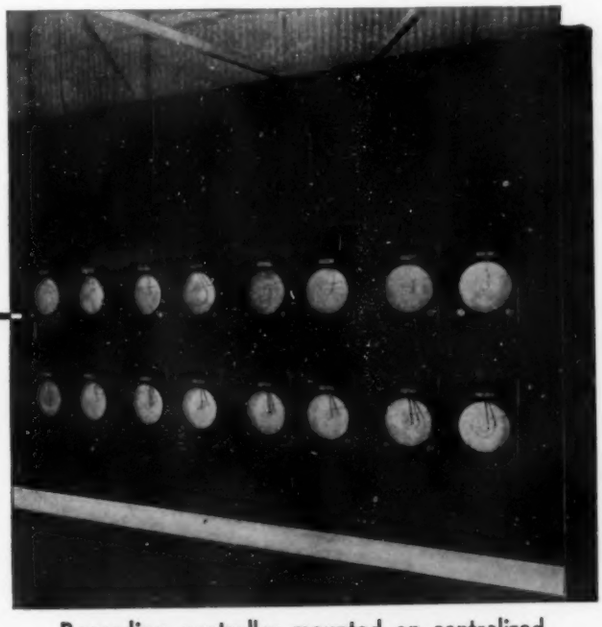
STEAM CYLINDER OILS • TECHNICAL WHITE OILS



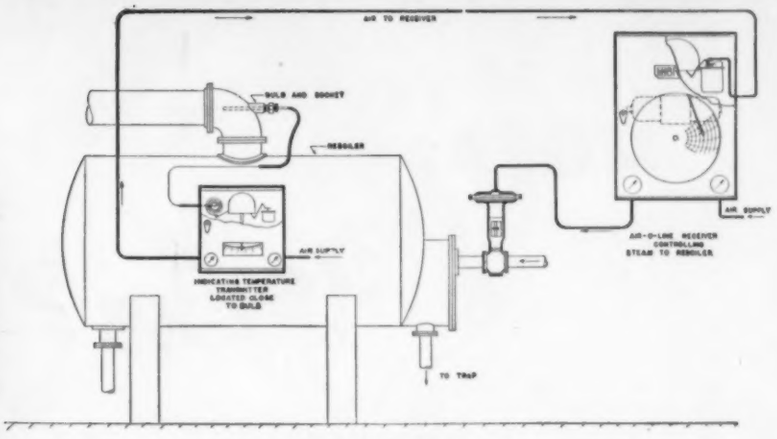
ALLIANCE OIL CORPORATION

Centralize REMOTE MEASUREMENT AND CONTROL with Safety

Indicating transmitter located at remote point of measurement.



Recording controller mounted on centralized control panel in control room.



PNEUMATIC TEMPERATURE TRANSMISSION SYSTEM

For Metering Temperature and Pressure

NEW-MATIC

Offers:

- ★ a proven system for the transmission of measurement by the use of air only instead of long lengths of sealed capillary.
- ★ instant response.
- ★ unimpaired accuracy.
- ★ positive positioning of pen. No pen "drag" or "over-shot."
- ★ opportunity for remote location of receiving instrument as much as 500 to 1,000 ft. distant from the point of measurement, instead of being limited to approximately 200 ft. as with capillary tubing.
- ★ use of multiple pen receivers to record measurements from 2 to 3 transmitters.
- ★ complete interchangeability of all receiving recorders or controllers.
- ★ operator an indication at the point of measurement in addition to the recorder in the control room.
- ★ initial cost comparable with capillary instruments where distances involved approximately 175 to 200 ft.
- ★ lower installation and maintenance costs.
- ★ ease of repair of connecting tubing, on the job, without return to shop or manufacturer. No recalibration required.

Eliminates:

- hazard and inconvenience of "out of service" instruments due to damage to capillary.
- initial and replacement cost of long lengths of capillary tubing.
- necessity for recalibration when breaks in connecting tubing occur.

The Brown Pneumatic Remote Transmission System is safe, stable, accurate and powerful, and lends itself admirably to the growing demand for centralized recording and control without any of the drawbacks attendant to long lengths of meter piping or capillary tubing, and where the use of electricity is not desirable.

Further information will be sent on request. Write THE BROWN INSTRUMENT COMPANY, *a division of Minneapolis-Honeywell Regulator Co.*, 4478 Wayne Avenue, Philadelphia, Penna. Offices in all principal cities. Toronto, Canada: 117 Peter Street—Amsterdam-C, Holland: Wijdesteeg 4—England: Wadsworth Road, Perivale, Middlesex—Stockholm, Sweden: Nybrokajen 7.

BROWN *NEW-MATIC* TRANSMISSION SYSTEM

FOR TEMPERATURES . . . PRESSURES . . . FLOWS . . . LIQUID LEVELS

Speed production in your plant with modern GAS equipment

Under the pressure of today's demand for a faster tempo in industrial production, new bottlenecks often emerge—bottlenecks that restrict production flow, make delivery dates a nightmare and limit sales and profit possibilities.

If the bottleneck in your plant is in your industrial heating equipment, it may well be that Gas and the latest type Gas equipment can solve your problem.

For Gas is today's fastest fuel. It cuts heating-up time and reduces firing time cycles. It is above all else flexible and adaptable to any production need. Accurately controllable as to both temperature and furnace atmosphere, it lends itself readily to high speed precision manufacture. It saves storage space, labor and handling costs, and in countless installations is proving itself today's most versatile fuel.

No matter what your industrial heating problem may be, it will pay you to investigate Gas and modern Gas equipment. Your Gas Company will be glad to show you how Gas can step up your own production and, if you wish, give you facts on how other companies in your line have used Gas equipment to solve specific problems in manufacturing.

AMERICAN GAS ASSOCIATION
INDUSTRIAL GAS SECTION . . . 420 LEXINGTON AVE., NEW YORK CITY

MORE PROOF

that GAS speeds production, improves quality, cuts costs.

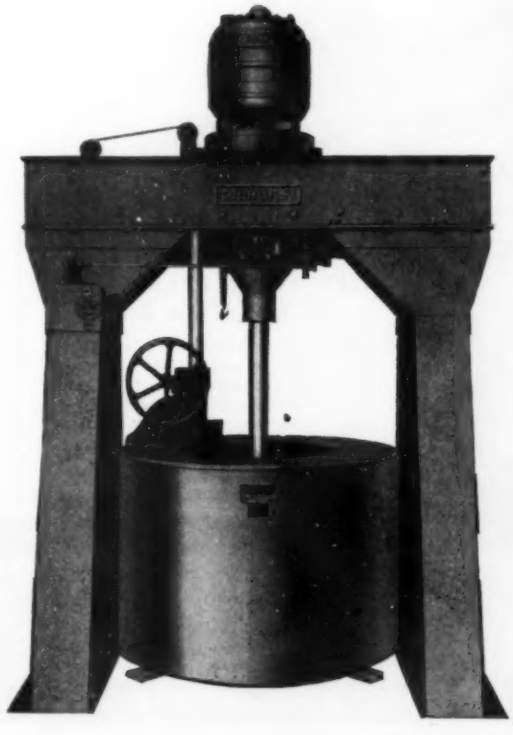
Varnish cooking is a critical exacting operation, requiring speedy controllable heat. In the Newark plant of the **Pittsburgh Plate Glass Company,** this responsibility is placed upon Gas. Just another of the made-to-order jobs for an industrial fuel that has no equal in ticklish manufacturing situations.

As for the **Troy Sunshade Co.**, Troy, Ohio: "Maintenance of uniform temperature in all parts of the oven . . . insures a uniform bake and superior finish when using synthetic enamel," says the management. Product is high-quality tubular furniture, where better finish, saving in time and fuel savings count.

In most of today's industrial processes, Gas and modern Gas-fired equipment is the answer to the demand for faster production, improved quality of work, and low fuel cost. Why not investigate Gas-fired equipment for your own processing problems?

WANTED: Plant men looking for the best way to save time and cut costs on SEPARATING, CLARIFYING, DEHYDRATING, THICKENING, FILTERING, DRAINING PROCESSES.

THE best way to save time and cut costs on any or all of the above processes is to turn to TOLHURST CENTRIFUGING. That's what most of America's chemical plants have done — and that's what they've found. Tolhurst maintains a complete Testing Laboratory for centrifugal research and is fully equipped to conduct trial runs on your own materials. For FREE BOOK on TOLHURST Suspended CENTRIFUGALS, simply fill in the coupon below and mail it today!



TOLHURST

SUSPENDED CENTRIFUGALS

American Machine and Metals, Inc., East Moline, Ill.

TOLHURST CENTRIFUGALS

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Yes! Send me FREE BOOK on Tolhurst Suspended Centrifugals for ☐ Separating; ☐ Clarifying; ☐ Dehydrating; ☐ Thickening; ☐ Filtering; ☐ Draining; ☐ Other Processes. _____

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Smooth Operator!

IT'S THE OIL THAT DOES IT!

MORSE ROLLER CHAIN Is Channel Lubricated

OIL GETS into the heart of the chain—the pin and bushing surfaces—led there by the channel lubrication system built into every link of interchangeable Morse Roller Chain.

With this positive means for unfailing lubrication, wear stays out! Morse Roller Chain, oiled inside and out, turns tough loads smoothly, quietly, delivering power with continued high efficiency through years of the hardest service. Special steels, precision manufacture, and advanced design work together to make this the finest roller chain available today!

Made in a complete range of sizes, in single and multiple widths. Up to 100 h.p. carried in stocks for immediate delivery at key cities all over the country.

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This comprehensive catalog and data book tells the whole story of Morse Roller Chains and sprockets. A valuable book for plant engineers, operating men, purchasing agents! Get your FREE copy by writing today to Morse, Ithaca.

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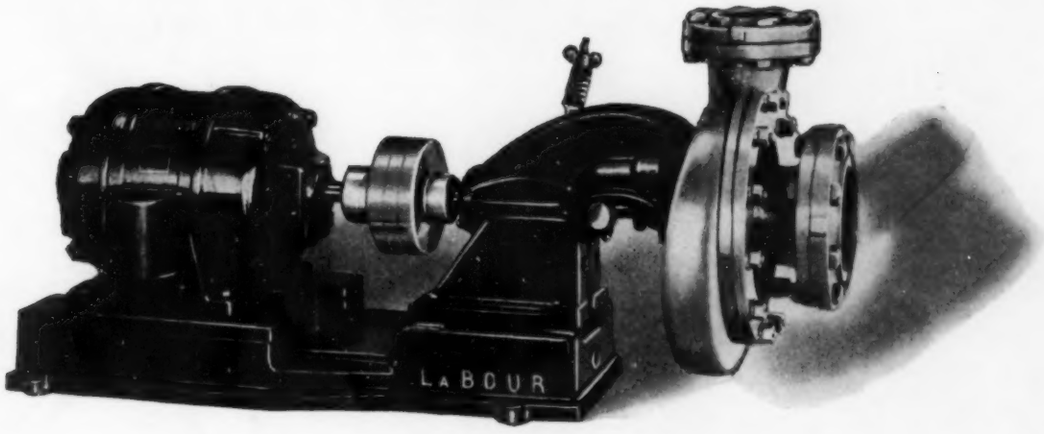
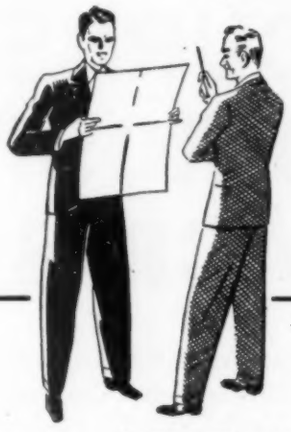


"We don't need a self-priming pump"



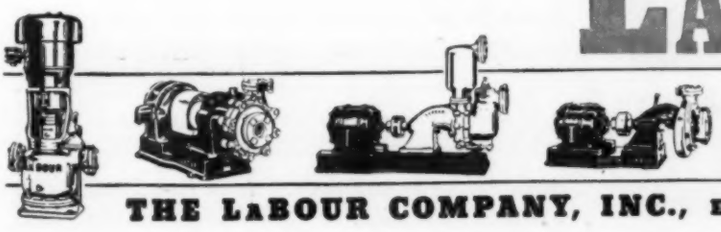
"But we do need dependability and low operating cost—"

LaBour Type Q is a non-priming centrifugal pump having unusually high efficiency as compared with other open impeller pumps. This efficiency is not dependent upon close-fitting parts, and consequently is not seriously reduced even after long and severe service. The result is a lower cost for operating power for every ton of acid or other liquid handled.

The dependability and interruption-free service of LaBour Pumps are widely known in the process industries, and every Type Q is subject to the same kind of exhaustive tests and inspections which each individual LaBour Pump must pass before shipment from the factory.

Do not overlook LaBour economy simply because the job you have in mind does not demand self-priming. Type Q may be able to save you many dollars per month. It's worth investigating, isn't it?

LABOUR



LaBOUR PUMPS

THE LABOUR COMPANY, INC., ELKHART, INDIANA, U. S. A.

NATIONAL LEAD COMPANY

New York, Baltimore, Buffalo, Chicago, Cleveland, Cincinnati, St. Louis; National-Boston Lead Co., Boston; John T. Lewis & Bros. Co., Philadelphia; National Lead & Oil Co., Pittsburgh; Georgia Lead Works, Atlanta; American Lead Corp., Indianapolis; Master Metals, Inc., Cleveland; The Canada Metal Co., Ltd., Toronto, Montreal, Winnipeg, Vancouver.

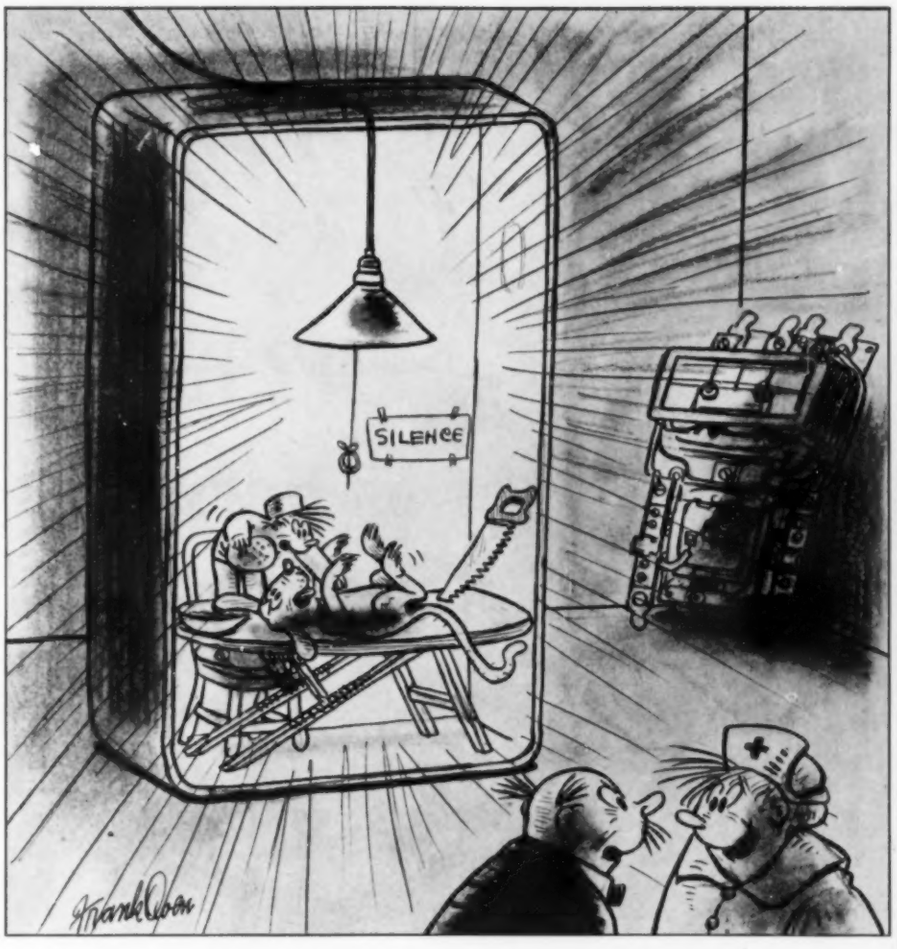
CURBS CORROSIVE ACIDS

You know what a curb bit does to an unruly horse—gentles it—helps bring it under control.

Tellurium Lead has the same effect on corrosive acids. From many different industries come user reports telling how this lead has subdued trouble-making acids—reports which state that Tellurium Lead has prolonged the life of equipment, even when the temperature has approached the melting point of the metal.

Another highly important property of Tellurium Lead is this: *It toughens under stress.* When rolled, stretched or hammered, it actually becomes stronger. As a result, turnover points and joints are less subject to cracking. Furthermore, where vibration occurs, this capacity to develop latent strength minimizes buckling and creeping. It also gives Tellurium Lead improved resistance to fracture due to repeated heat changes.

Tellurium Lead of our manufacture is time-tested St. Joe chemical lead alloyed with a small quantity of tellurium. It gives the advantages of this well-known chemical lead plus important new ones. Yet now it costs only a fraction of a cent more per pound than chemical lead. Available in sheets, pipe and coils. For further facts, write our nearest branch.



"It has such a shiny, white interior, he wants that cabinet for his clinic!"

That patented, white enameled interior on Allen-Bradley solenoid starters reflects light and illuminates the starter interior in those dark corners. Installation and inspection are made easy.

The Allen-Bradley solenoid starter has double break, cadmium silver contacts that never need cleaning or filing. They are always in first-class operating condition. There are no bearings to corrode or stick and, of course, no flexible jumpers to break. The ruggedness and simplicity of its construction greatly reduce the possibility of trouble. Thus, with bolted or oil-immersed starters, so frequently found in chemical process industries, the messy job of frequent starter maintenance is done away with.

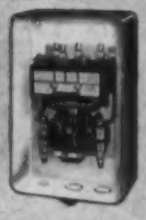
Allen-Bradley solenoid starters are available in many special enclosures, to resist moisture, dust, and explosive and corrosive gases. You'll find an Allen-Bradley enclosure to meet your special chemical plant requirements.

Allen-Bradley Company — Milwaukee, Wisconsin

ALLEN-BRADLEY
SOLENOID MOTOR CONTROL

SOLENOID STARTERS for Every Process Industry Service

ACROSS-THE-LINE



Bulletin 709—For across-the-line starting of squirrel-cage motors. Has double break, cadmium silver alloy contacts.

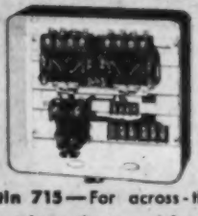
COMBINATION

Bulletin 712—A solenoid starter and hand disconnect switch combined in one cabinet. Reduces installation time.

REVERSING

Bulletin 705—For reversing squirrel-cage motors. Has two solenoid starters provided with mechanical interlock.

MULTI-SPEED



Bulletin 715—For across-the-line starting of two, three, and four-speed motors. Solenoid switch construction.

Send for "THE STORY OF THE SOLENOID STARTER"

Allen-Bradley Company
1337 So. First St.
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Please send me "The Story of the Solenoid Starter."

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Company .....

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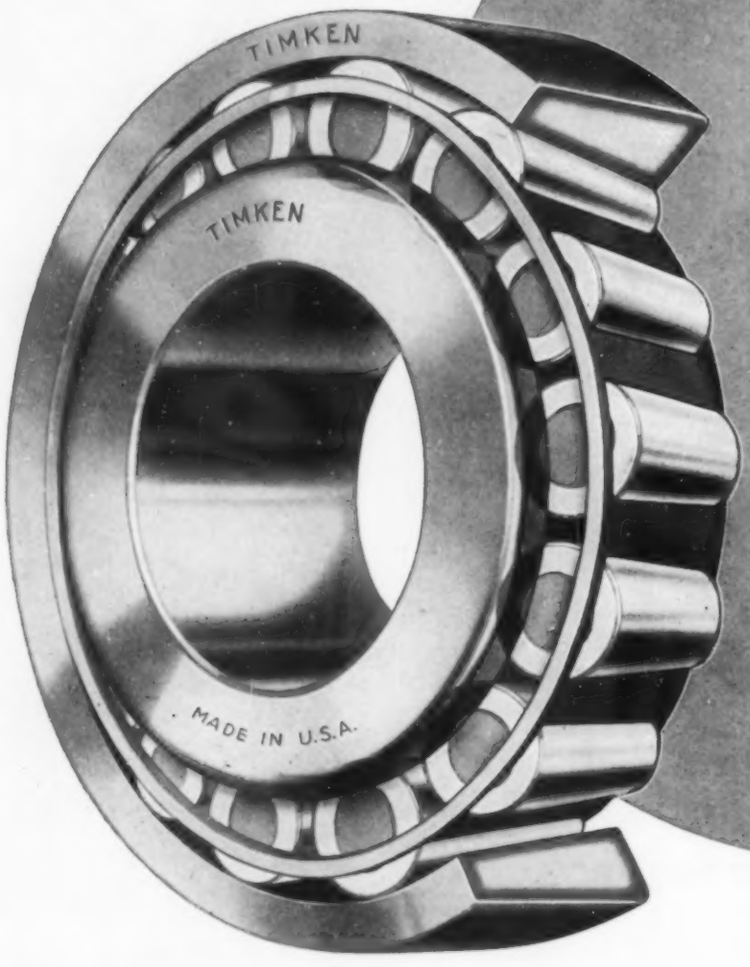
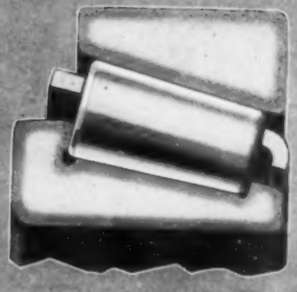
The TIMKEN *Bearing of Today*



WITH 42 YEARS OF DEVELOPMENT BEHIND IT . . .



THESE X-ray pictures show the highly-refined TIMKEN Bearing of today—with all of the vitally important improvements that have been made since Timken introduced the first TIMKEN Bearing 42 years ago. Such improvements as *positive roller alignment* through wide-area contact of roller ends with the undercut rib of the cone; the *one-piece multiple-perforated cage* which assures dead-accurate spacing of the rollers around the periphery of the bearing; TIMKEN Electric Furnace Alloy Steel for supreme strength and endurance; and TIMKEN Bearing finish —the finest finish known to modern bearing science.

The consummation of these improvements has resulted in the highest quality and most efficient tapered roller bearings ever produced—with performance that is correspondingly outstanding; all designated by the trade-mark "TIMKEN" stamped on the cone and cup of every TIMKEN Bearing.

It will pay you well to make sure that every piece of machinery you buy is Timken Bearing Equipped.

Manufacturers of TIMKEN Tapered Roller Bearings for automobiles, motor trucks, railroad cars and locomotives and all kinds of industrial machinery; TIMKEN Alloy Steels and Carbon and Alloy Seamless Tubing; and TIMKEN Rock Bits.

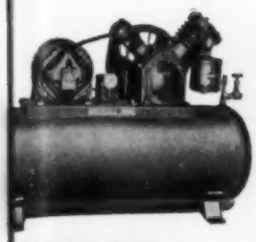
TIMKEN
TAPERED ROLLER BEARINGS

THE TIMKEN ROLLER BEARING COMPANY, CANTON, OHIO

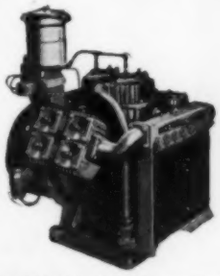
There is a Reason for the

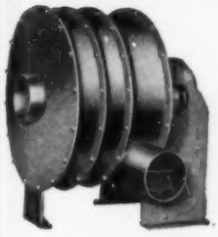
1000 TYPES and SIZES of I-R Compressors

- FOR AIR OR GAS
- FOR ANY PRESSURE
- FOR ANY SERVICE



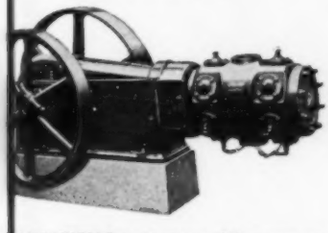
TYPE 30 AIR-COOLED—Pressures to 1000 lbs and vacuums. Sizes ¼ to 15 hp.

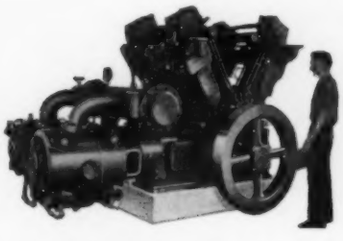




MOTORCOMPRESSOR—Two-stage, air-cooled. Pressures 80 to 125 lbs. 15 to 75 hp sizes.

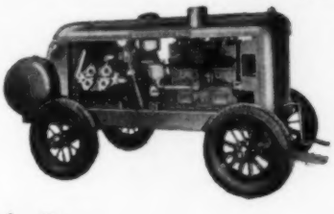
TYPE G MOTORBLOWER—Pressures ½ to 2 lbs. 2 to 30 hp sizes.





HEAVY DUTY for air or gas. All pressures vacuums. 5 to 125 hp sizes. Any type drive.

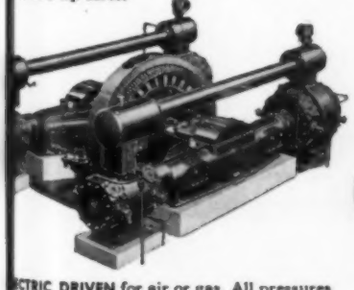
XVO DIESEL-POWERED for air or gas. All pressures and vacuums. 60 to 240 hp sizes.

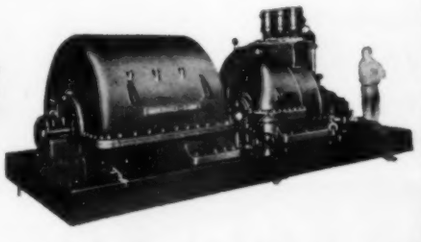


PORTABLES—Two-stage, air-cooled. Gasoline or oil power. All standard mountings. Sizes 55 to 500 cfm.

-XCB HEAVY DUTY for air or gas. Belt or tric drive. All pressures and vacuums. to 250 hp sizes.

XPV STEAM DRIVEN for air or gas. All pressures and vacuums. 50 to 1500 hp sizes.





CTRIC DRIVEN for air or gas. All pressures cuums. Sizes 200 to 3000 hp.

TURBO BLOWERS—Steam driven or electric-motor-drive for large volumes and relatively low pressures. Sizes to 12,000 hp.

EACH TYPE of Ingersoll-Rand compressor illustrated on this page meets the conditions of some particular kind of service better than any other kind. Some types are strictly air compressors; others handle either air or gas.

Some are for permanent stationary installations; some are for semi-stationary installation and can be readily relocated; others are fully portable units for the transit job.

Each type is built in a complete range of sizes. In fact the whole field of compressor needs ranging from vacuums to 15,000 lbs per square inch pressure and sizes from ½ to 12,000 hp is covered by the Ingersoll-Rand line. Units are built for all types of drive.

Your present compressor may be giving no hint of needing replacement. You should, nevertheless, periodically check its performance against a new and modern Ingersoll-Rand compressor. Only in this way will you know when excess operating costs and maintenance expense exceed the investment charges of a new and more efficient machine.

A representative of the nearest Ingersoll-Rand branch office will be glad to help you.

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867-14

A COCK THAT BOTH ENGINEERS AND MEN WILL OK.
FOR BOILER BLOW-OFF, WATER COL. BLOW-OFF, ETC.
For PRECISE, CLOSE CONTROL TRY BAR STOCK VALVES IN YOUR PLANT
READING-PRATT & CADY
AMERICAN CHAIN & CABLE COMPANY Inc.
FOR 350 LB. STEAM AND BOILER FEED WATER LINES. FOR THROTTLING VALVE ON HIGH PRESSURE PROCESS STEAM LINES.
FOR CLOSE CONTROL, SIZES TO 1". PRECISION MACHINED FROM BAR STOCK. BRONZE, CARBON STEEL, STAINLESS STEEL.
COLUMBIA MISSOURI Saves $25,000 yearly in fuel cost alone
CAST STEEL VALVES FOR MAIN STEAM, FEED WATER AND AUXILIARY LINES IN STEAM POWER PLANTS.
LUBROTITE GATE VALVES FOR CORROSIVE AND ABRASIVE GASES AND LIQUIDS TO INSURE ABSOLUTE TIGHTNESS.
4 Reasons for the Better Service You Get from these CLIP GATE Valves
THE CLIP GATE VALVE WITH LOWEST REPLACEMENT COST.

Reading-Pratt & Cady Valves can earn their place with you, too

You will find Reading-Pratt & Cady valves working on process steam or material handling lines in soap plants, refineries, tanneries, textile plants, chemical laboratories, packing houses, paper mills and so forth—each earning its place because of its ability to

reduce valve maintenance cost and cut delays caused by valve maintenance

You will find Reading-Pratt & Cady valves, too, in the steam power plants of industrial concerns, public utilities and municipalities—in many of the modernized plants that have reached a new low for KW production cost.

That sort of experience is at your service—another reason for being sure to get a Reading-Pratt & Cady recommendation when you are discussing the valves you use.

READING-PRATT & CADY
DIVISION · · READING, PENNSYLVANIA

AMERICAN CHAIN & CABLE COMPANY, Inc.

"It pays us to use GULF QUALITY LUBRICANTS--

--our records prove it!" ...says this Chief Engineer

This large Diesel Plant is making an outstanding record of economical operation with Gulf's higher quality lubricants.

"GULF PERIODIC CONSULTATION SERVICE helps us keep maintenance costs down"

"WE feel sure that Gulf's higher quality lubricants have played a big part in the outstanding operating record we've made in our plant," says this Chief Engineer. "Our big Diesels are in top-notch condition—our maintenance costs are lower than they have ever been."

Here's one important reason why you can expect better results with Gulf Diesel Lubricating Oils: They are specially refined to withstand high temperatures, contamination with fuel and moisture, and constant churning in the presence of air. *And* more than 50 leading manufacturers have approved Gulf Diesel Oils for lubrication of the engine they build. Call in a Gulf Engineer—ask him to explain GULF PERIODIC CONSULTATION SERVICE and how it can help you get more lubrication value per dollar. Write or phone your nearest Gulf office today.

GULF INDUSTRIAL LUBRICATION

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Please send me my copy—no charge—of the booklet "GULF PERIODIC CONSULTATION SERVICE."

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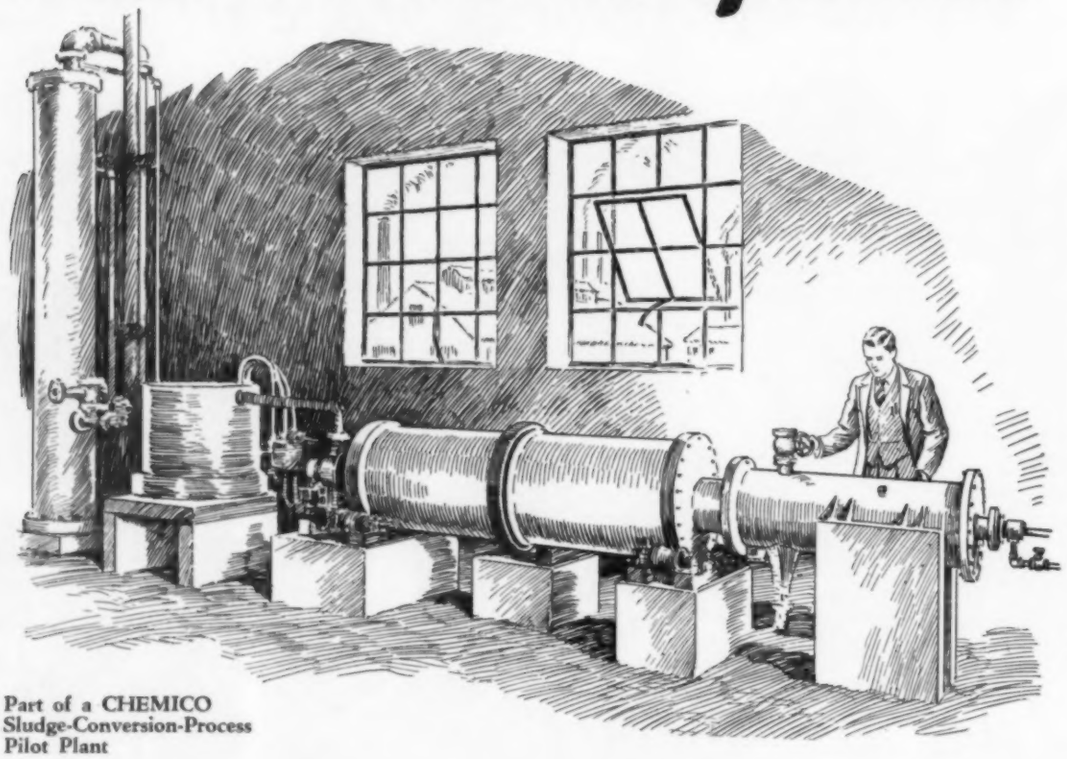
CHEMICO
Process Development



Part of a CHEMICO
Sludge-Conversion-Process
Pilot Plant

Creator of new techniques in acid recovery

For 26 years, CHEMICO has pursued an unremitting search for more effective processes and more efficient equipment in acid recovery. This development work has been conducted through unequalled laboratory facilities and the operating records of dozens of Chemico plants. In addition, the Chemico organization includes scientists of world renown, whose achievements have in large measure revolutionized the technique of acid recovery.

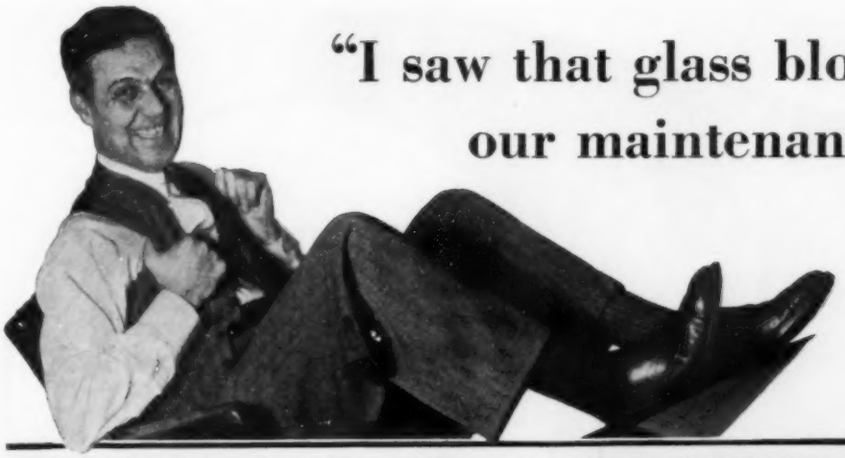
Today, acid recovery is more economical, the equipment costs less, and the results can be uniformly excellent—because of Chemico research.

Whether your acid requirements are large or small, you can depend upon authoritative recommendations from Chemico. Your inquiry is invited without obligation on your part.

CHEMICAL CONSTRUCTION CORPORATION

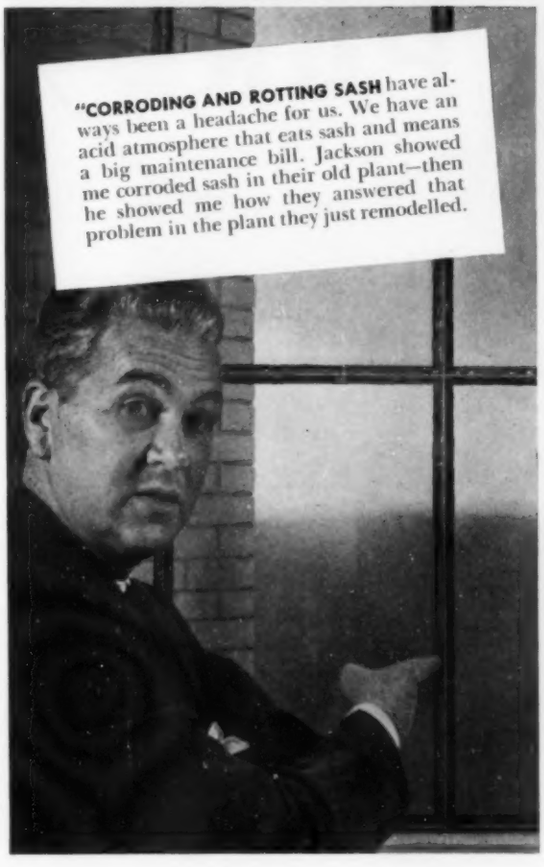
Main Offices: 30 Rockefeller Plaza, New York
Cables: Chemiconst, New York
European Representatives: Cyanamid Products, Ltd., Berkhamsted, Herts., England.

CHEMICO PLANTS are PROFITABLE INVESTMENTS



"I saw that glass blocks could reduce our maintenance troubles"

. . . that's why the trip through Jackson's plant was the best day's work I ever did."



"CORRODING AND ROTTING SASH have always been a headache for us. We have an acid atmosphere that eats sash and means a big maintenance bill. Jackson showed me corroded sash in their old plant—then he showed me how they answered that problem in the plant they just remodelled.

"GLASS BLOCKS CUT MAINTENANCE costs because neither the blocks nor the mortar joints in the panel are harmed by the acid, humid atmosphere. Jackson says that their cleaning bill is less, because the panels of PC Glass Blocks are so easy to clean.

"TEMPERATURE AND HUMIDITY control are a lot easier with glass block panels in place of regular windows. Even in cold weather it is warm near the panels, because the blocks have such a high insulation value — more than twice that of ordinary windows.

"THE CLEANLINESS of that plant astounded me. I leaned on a sill and there wasn't enough dirt to soil my suit at all. No dirt can filter through the sealed panel of PC Glass Blocks. That means less spoilage in plants where purity of products is important.

"THE WORKMEN TOLD ME that the plant is a more pleasant place to work now that they have big glass block panels. They have plenty of natural daylighting, which aids seeing, helps them maintain product uniformity, and makes careful inspection easier."

IN hundreds of plants all over the country, PC Glass Blocks are helping to reduce maintenance costs, improve production and provide better daylighting. Hardly an industry exists that cannot benefit from the practical advantages of this modern light-transmitting material.

Before you make any plans for new construction or plant modernization, get the facts about PC Glass Blocks. Write for our big, illustrated book which shows how PC Glass Blocks have been used in industrial plants—and how they can help you. Just mail the coupon below.

PITTSBURGH PC CORNING

"PITTSBURGH" stands for Quality Glass

GLASS BLOCKS

Distributed by

PITTSBURGH PLATE GLASS COMPANY

and by W. P. Fuller & Co. on the Pacific Coast

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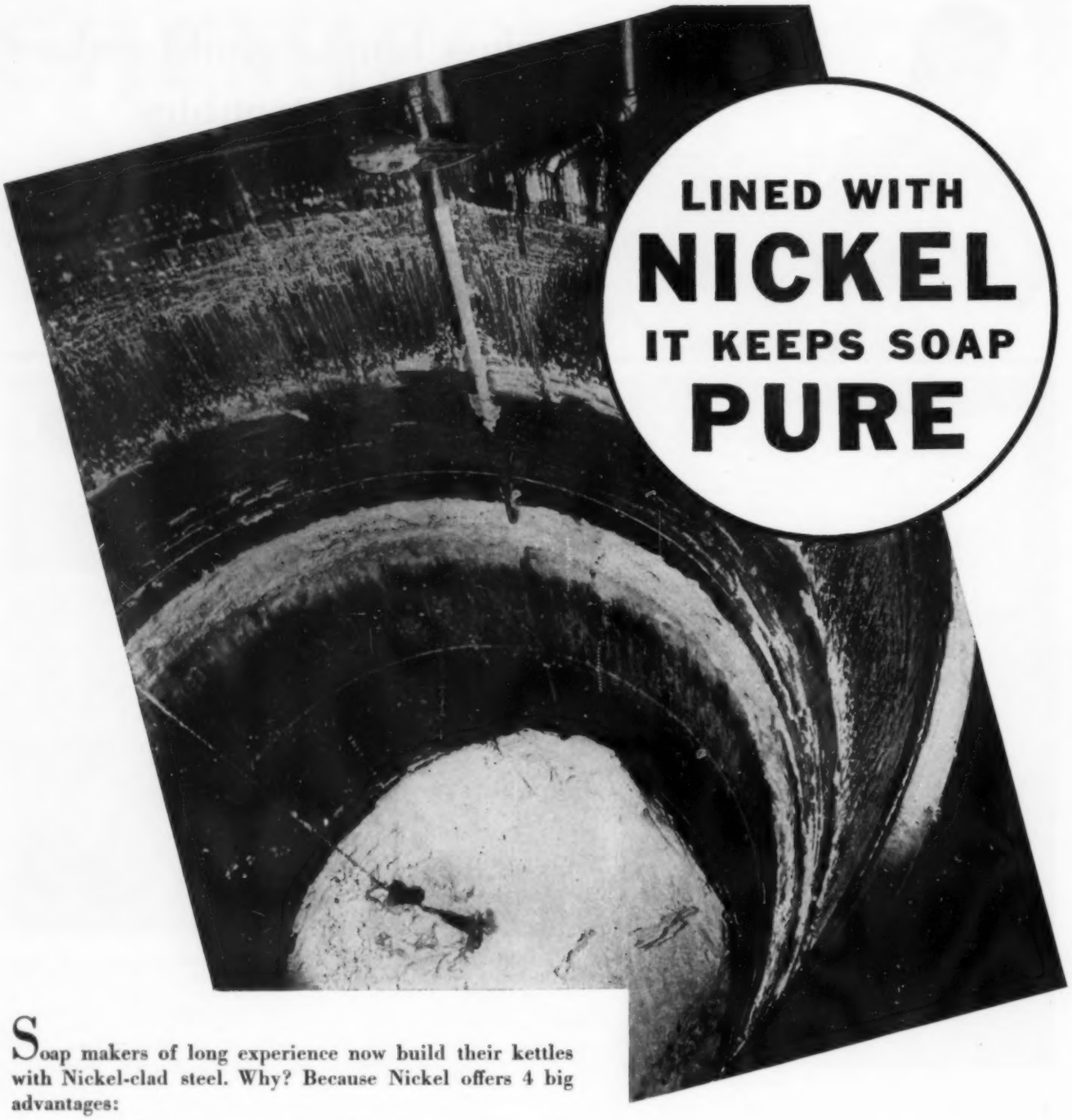
Address_____

City_____ State_____



LINED WITH NICKEL IT KEEPS SOAP PURE

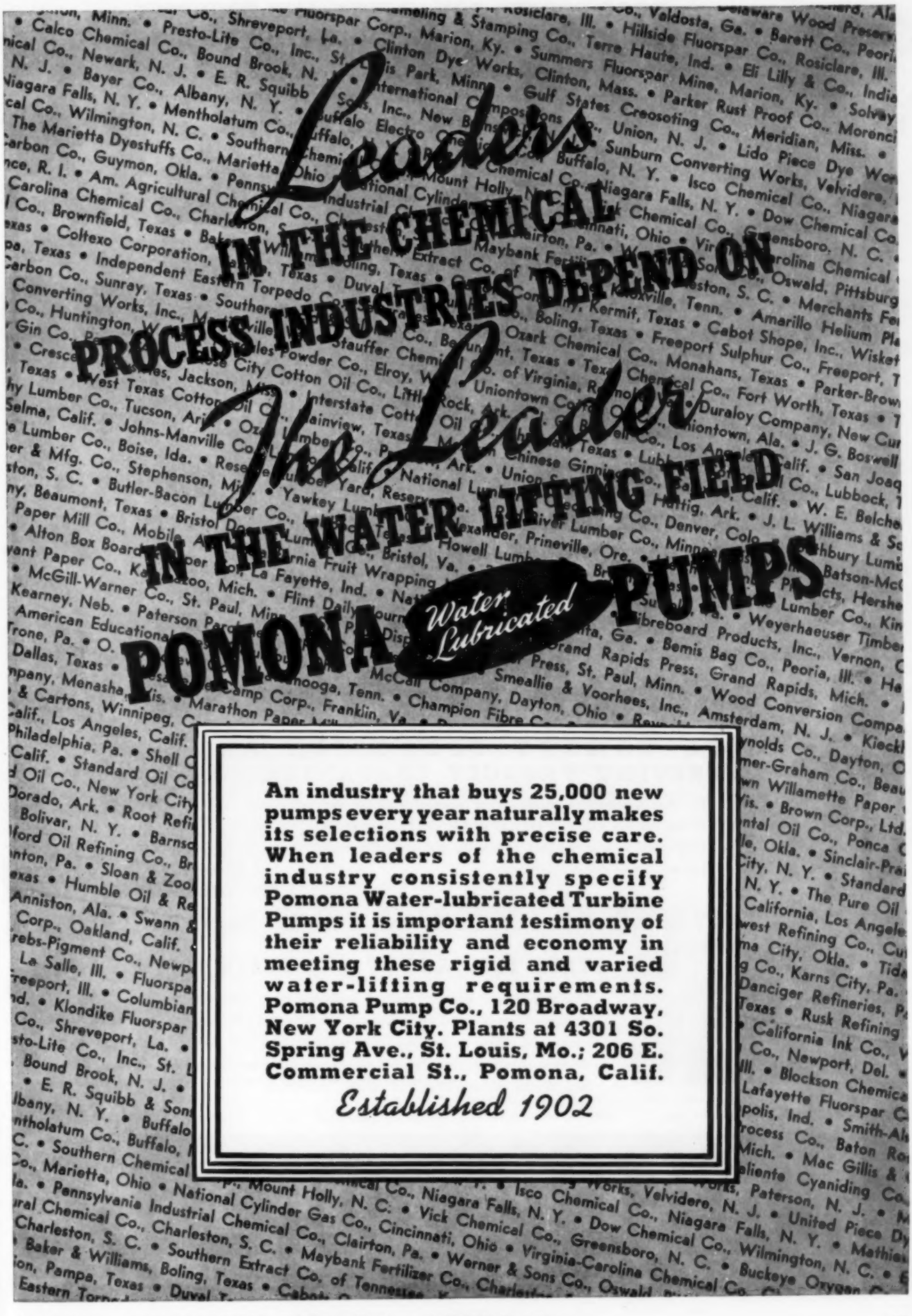
Soap makers of long experience now build their kettles with Nickel-clad steel. Why? Because Nickel offers 4 big advantages:

1. ***Resistance to effects of hot fats, caustic and salt.***
2. ***Elimination of a potent source of iron pick-up.***
3. ***Effective prevention of contamination and discoloration.***
4. ***Exceptionally long life, with substantial savings on maintenance.***

Nickel-clad steel soap kettle built by Southwest Welding & Manufacturing Co., Alhambra, California

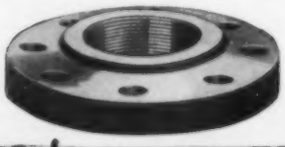
Assure purity for your product, and long, economical life for equipment. Specify Nickel-clad steel for soap kettles. Write for Bulletin C-1, "Monel, Nickel and Inconel in Soap and Related Products Industries". Address:

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK, N. Y.


Leaders
IN THE CHEMICAL
PROCESS INDUSTRIES DEPEND ON
The Leader
IN THE WATER LIFTING FIELD
POMONA Water Lubricated PUMPS
An industry that buys 25,000 new pumps every year naturally makes its selections with precise care. When leaders of the chemical industry consistently specify Pomona Water-lubricated Turbine Pumps it is important testimony of their reliability and economy in meeting these rigid and varied water-lifting requirements. Pomona Pump Co., 120 Broadway, New York City. Plants at 4301 So. Spring Ave., St. Louis, Mo.; 206 E. Commercial St., Pomona, Calif.
Established 1902

DROP FORGED FOR SAFETY AND ECONOMY TO MEET THE MOST TRYING CONDITIONS

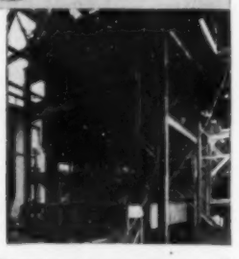
Valves, Fittings and Flanges by Vogt — the choice of operating men everywhere for safe and sure regulation of the high pressure and high temperature liquids and gases used in modern process work.



• • Vogt PRODUCTS are • •

HIGH OPERATING EFFICIENCIES AND LOW MAINTENANCE COSTS

More steam per dollar of investment—because Vogt Boilers are designed and built to fit in with specific operating conditions. Available in bent tube, sectional header, box header and return tubular types using coal, oil, gas or waste heat for fuel.



• • DESIGNED to RAISE • •

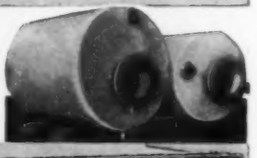
MEETING THE DEMANDS FOR OPERATING SECURITY

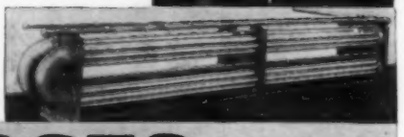
Vogt has every facility for the fabrication of stills, towers, continuous rotary filters, filter presses, oil chilling machines, heat exchangers, etc., and these products are serving the petroleum industry around the world.

• • OPERATING STANDARDS and • •

TO COMBAT CORROSION AND PREVENT PRODUCT CONTAMINATION

Process equipment made from special metals and alloys for the exacting service of the chemical plant is fabricated in our modern shops for many of the well known chemical companies.





• • LOWER YOUR COSTS • •

STEPS TONNAGE UP AND COSTS DOWN

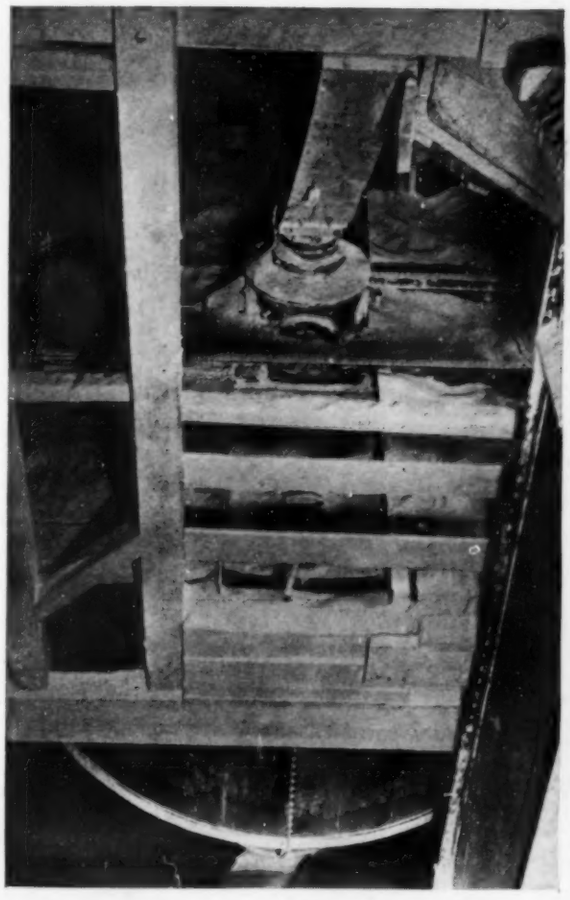
Our experience of more than a half-century in building profit-making ice and refrigerating machinery is at your command. We make complete units for ice and cold storage plants, packing plants, dairies, breweries, chemical plants, oil refineries and related industries.

Vogt PRODUCTS

NEW YORK
PHILADELPHIA
CLEVELAND
CINCINNATI
ST. LOUIS
CHICAGO
DALLAS

HENRY VOGT MACHINE CO., INCORPORATED LOUISVILLE, KENTUCKY

THIS *Minerals* COMPANY FOUND AIR SEPARATION THE ONLY ANSWER—*Selected*



GAYCO

CENTRIFUGAL AIR SEPARATOR

Air-separation (the GAYCO way) was successfully used by this Company to remove "fines" (—200 mesh) from their silica-like product. Their GAYCO operates 12 hours a day, handles an average of 170 tons. But that's not all. Their GAYCO enabled them to *step* up their grinding tonnage to maximum and, by its simplicity, has kept repairs and replacement cost practically *nil*. This is a typical GAYCO performance-story. It is a story of more uniform production, greater capacity, cleaner tailings, higher efficiency, covering the entire range of fines separation (from 60 to 400 mesh) by means of the exclusive GAYCO PATENTED CENTRIFUGAL SIZING FAN. Have you a separating problem?

• *We have the answer ready for you*

Do you want to save power? Overcome feed—variation troubles? Get greater uniformity? Insure quick, positive adjustment? Increase production? The answer is GAYCO. The facts are ready in our new "tell-all" Catalog.

SEND THIS COUPON

Universal Road Machinery Co.

RUBERT M. GAY—DIVISION
117 LIBERTY STREET
NEW YORK, N. Y., U. S. A.

MAIN OFFICE AND FACTORY KINGSTON, N. Y.

Canadian Representative
F. H. HOPKINS & CO., LTD.,
340 Canada Cement Bldg.,
Montreal, Que., Can.

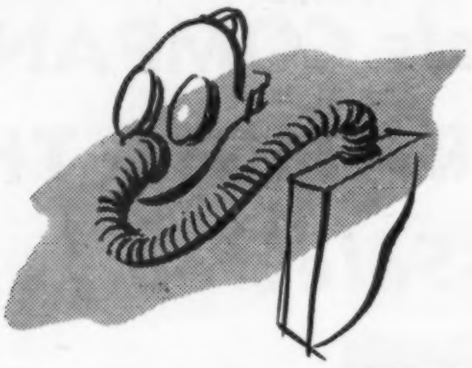
GAYCO CENTRIFUGAL SEPARATORS

Kindly send me a copy of the New GAYCO Catalog featuring the advantages of GAYCO Separators and data on materials that can be handled. We are interested in separating the following products .....

Name .....

Company .....

Title ..... Address .....



National Defense

During the last World War, we took an active part in munitions production.

Today, with twenty-five years of additional experience, we are better equipped to contribute more broadly to the Defense Program.

Our specialized equipment and engineering apply to the

Treatment of Process Water

Treatment of Plant Wastes

Concentration and Purification of Strategic Metals

Manufacture of Heavy Chemicals

If you are faced with a problem relative to the above, write for further information. Or better still, ask a Dorr engineer to call.

DORRCO

THE DORR COMPANY INC.

ENGINEERS • 570 Lexington Ave., New York

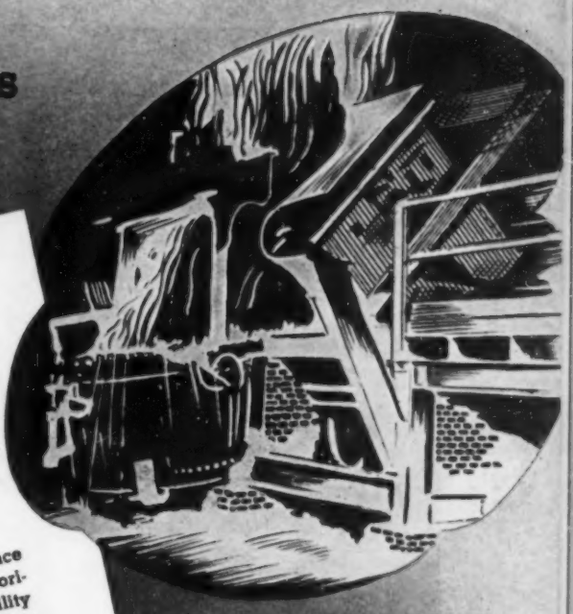
ATLANTA • TORONTO • CHICAGO • DENVER • LOS ANGELES

DORR TECHNICAL SERVICES AND EQUIPMENT ARE ALSO AVAILABLE FROM THE FOLLOWING COMPANIES:

NETHERLANDS: Dorr-Oliver N.V., The Hague • ENGLAND: Dorr-Oliver Company Ltd., London • GERMANY: Dorr Gesellschaft, m.b.H., Berlin • FRANCE: Soc. Dorr-Oliver, Paris
ITALY: S.A.I. Dorr-Oliver, Milan • JAPAN: Sanki Eng. Co. Ltd., Tokyo • SCANDINAVIA: A.B. Hedemora, Hedemora, Sweden • AUSTRALIA: Crossle & Duff Pty. Ltd., Melbourne
ARGENTINA: Luis Flora, Buenos Aires • SOUTH AFRICA: Edward L. Bateman, Pty. Ltd., Johannesburg • BRAZIL: Oscar Toxes & Co., Rio de Janeiro

HANDLING HEAT
for the Metal Working Industries

NORTON SERVICE



Melting Metal . . .

Resistance to high temperatures, chemical resistance toward oxides and low permeability toward molten metals — these are the features of Norton Cements and Bonded Shapes (Alundum, Crystolon and fused magnesia) that are reducing lining costs in many types of furnaces for melting ferrous and non-ferrous metals.

Sintering Metal . . .

Because they have high electrical resistance even at elevated temperatures, high refractoriness, high heat conductivity, high permeability and low coefficient of expansion, Alundum Tubes are showing outstanding performance in high temperature, wire wound electric resistance furnaces of all kinds — especially in the drawing and swaging of tungsten and molybdenum wire and sintering cemented carbides for tools.

Hardening Metal . . .

High refractoriness, great strength, high heat transfer, resistance to spalling and resistance to abrasion — these five features of Crystolon Hearth Plates and Crystolon Muffles are assuring long lining life and low fuel costs in heat treating furnaces of many types.

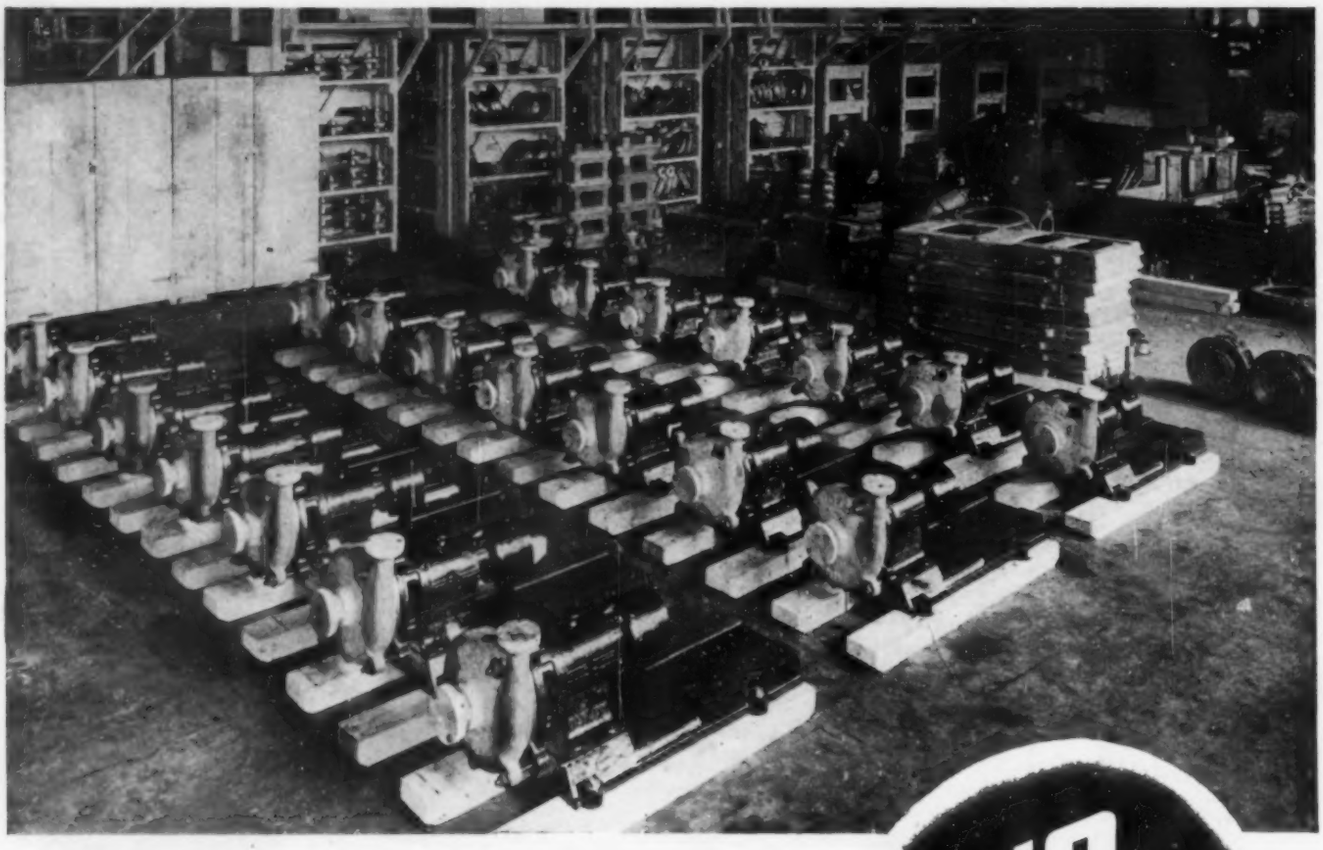
Enameling Metal . . .

From the high refractoriness and chemical stability of Alundum Muffles for enameling furnaces comes their ability to give long, trouble-free service. From their high strength which allows plates of thin cross-section and their high heat conductivity comes their ability to cut fuel costs by passing heat quickly from source to work.

NORTON COMPANY
Worcester, Mass.

R-662

NORTON
REFRACTORIES



MORE PROOF OF *Cost Saving* EFFICIENCY

The above group of Wilfley Acid Pumps, ready for shipment, is concrete evidence that outstanding PERFORMANCE *does* bring repeat orders for WILFLEYS. Trial installations invariably result in orders for *additional* pumps. By ordering four, ten, fourteen—and even FORTY pumps at a time—many plants are rapidly changing over to WILFLEYS exclusively.

Elimination of the stuffing box means no stuffing-box trouble or contamination. Continuous 24-hour operation without attention. Effective sealing blades solve leakage problem. Made in 10- to 1,000-G.P.M. capacities; 15- to 150-ft. heads—and higher. Handles acids, hot liquids, corrosives, alkali and mildly abrasive solutions easily, safely and economically. Write today for complete details.

A. R. WILFLEY & SONS, INC., Denver, Colorado, U. S. A.
NEW YORK OFFICE: 1775 BROADWAY, NEW YORK CITY

NO STUFFING BOX

SATISFACTION *THAT BRINGS* **REPEAT ORDERS**

WILFLEY

DIRECT DRIVE • BELT DRIVE • UNITARY • ACID PUMPS

ANOTHER DISTINCTIVE PRODUCT SUCCESS achieved BY MULLING in the new SIMPSON INTENSIVE MIXER

(BUILT IN TEN SIZES)

ROSTONE
CORPORATION
BUILDING PRODUCTS OF COLORFUL RECREATED STONE
LAFAYETTE
INDIANA

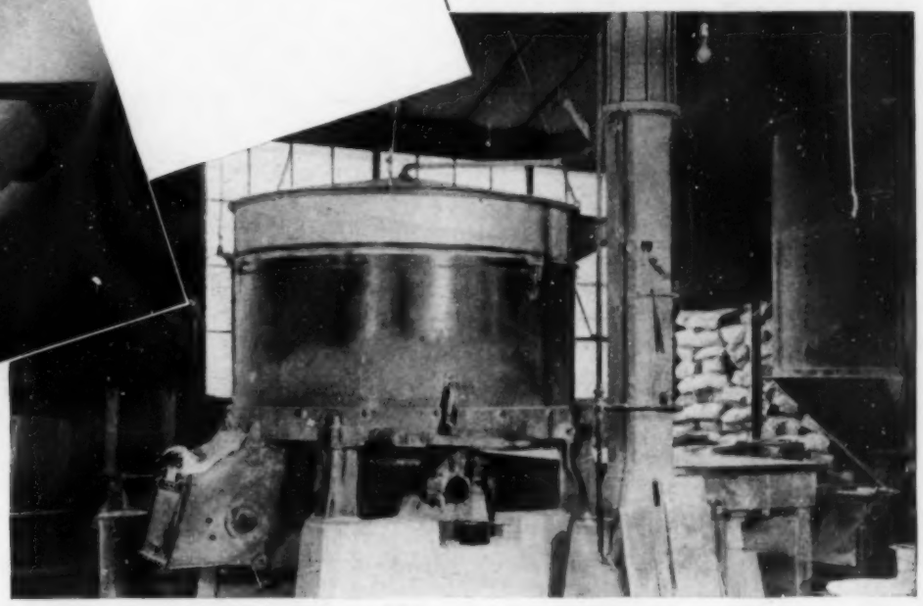
October 8, 1940

National Engineering Company
549 West Washington Boulevard
Chicago, Illinois

Gentlemen:

In regard to the Simpson Mixer being used for building products, we are pleased to advise that all raw materials, consisting of shale, lime, mineral pigments, and aggregate usually in the form of limestone particles, are thoroughly mixed with a small amount of water. It may also be of interest to recall to your mind that we have installed in connection with the Simpson Mixer an Aerator which breaks up the mixed material into a uniformly pressable powder.

Yours very truly,
ROSTONE CORPORATION
Lloyd P. Wyman
Vice-President



No. 2—6' Dia. Pan Simpson Mixer on artificial stone in the plant of Rostone Corp., Lafayette, Ind., with heavy 1600 lb. adjustable mullers, revolving in a closed pan for dust suppression, and with the National Aerator for automatic disintegration of the mulled body as discharged from the mixer.

"COLORFUL RECREATED STONE"

consisting of shale, lime, mineral pigments, aggregate and moisture, thoroughly combined by the intensive mulling action of the Simpson Mixer to produce durable and distinctive new building products for modern home and industrial construction.

We are proud of the fact that the Simpson Mixer has again met a severe test and has demonstrated its ability to produce a strictly integrated product of this type with an exceptionally stiff mixture and small percentages of color and other elements, when former grinding and stirring methods proved inadequate.

Scores of mixing problems, wherein uniformity is important, have been solved successfully throughout the Process Industries on all classes of dry, plastic and semi-plastic materials by the new "Mulling Process of Mixing" in the modern heavy-duty, low-cost Simpson Intensive Mixers. Many of these have begun in our Laboratory, where complete facilities are available, without obligation, to demonstrate the machines.

INVESTIGATE THE SIMPSON MIXER NOW FOR GREATER UNIFORMITY AND LOWER MANUFACTURING COST IN THE PROCESSING OF YOUR SPECIAL PRODUCTS

NATIONAL ENGINEERING COMPANY

MACHINERY HALL BUILDING, CHICAGO, ILLINOIS, U. S. A.

Manufacturers and Selling Agents for Continental European Countries:—The George Fischer Steel & Iron Works, Schaffhausen, Switzerland. For the British Possessions, Excluding Canada and Australia—August's Limited, Halifax, England. For Canada—Dominion Engineering Co., Ltd., Montreal, Canada. For Australia and New Zealand—Gibson, Battle & Co., Pty., Ltd., Sydney, Australia

Look at the Difference

IN THESE TWO VARNISH FIRE PITS

AT the left you see a coke fired pit lined with fireclay brick. It had been in operation 6 months. Note the clinker adhesion around the rim. Then compare this with the clean, clinker-free edges of the "Carbofrax" lined pit shown below which had then been in service for the same length of time.

THIS is the "Carbofrax" lined pit. Clinker doesn't stick to "Carbofrax" brick because the brick do not soften under heat. The edges of the lining are sharp and clean because "Carbofrax" is strong enough to withstand mechanical abuse. This pit has now been in service three and one half years and is still in excellent condition. Investigate "Carbofrax" brick for your varnish fire pits.

REFRACTORY
CARBORUNDUM
REG. U. S. PAT. OFF.
PRODUCTS

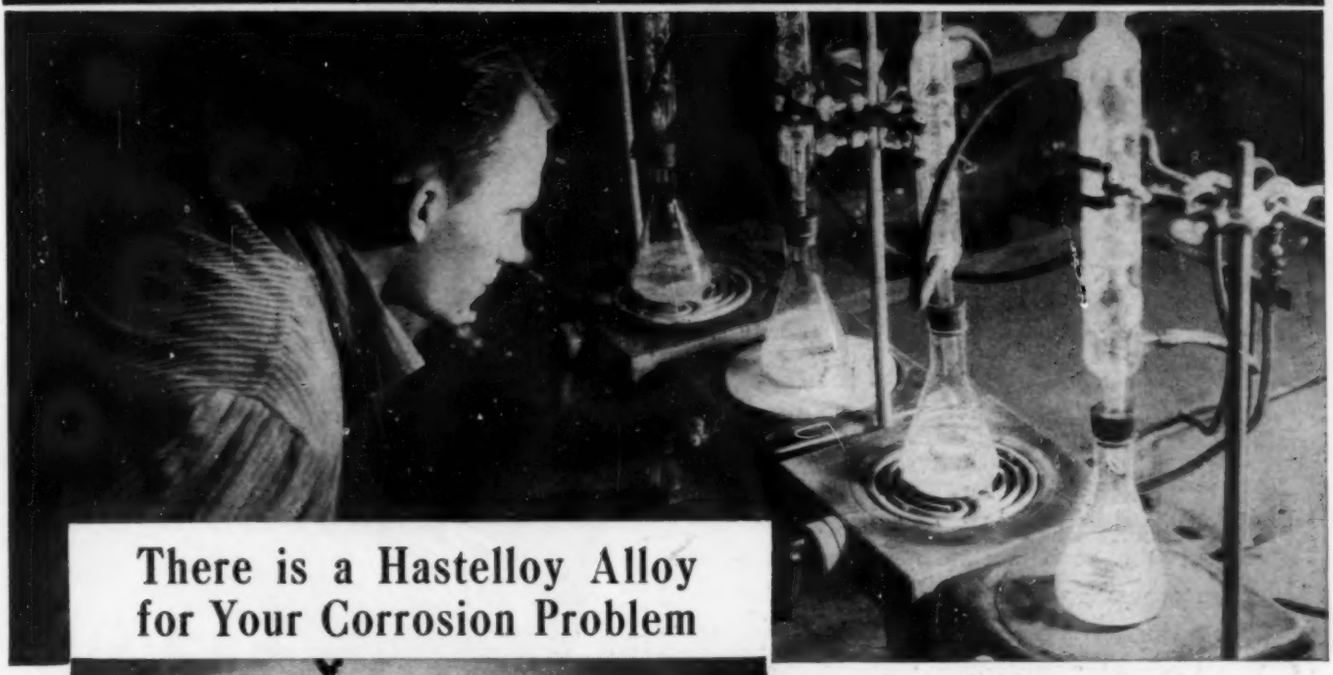
THE CARBORUNDUM COMPANY, REFRACTORY DIVISION, PERTH AMBOY, N. J.

REG. U. S. PAT. OFF.

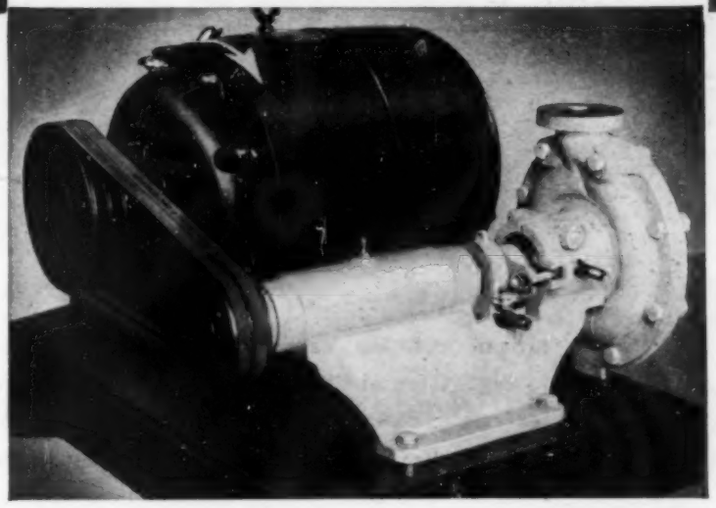
District Sales Branches: Chicago, Philadelphia, Detroit, Cleveland, Boston, Pittsburgh. Distributors: McConnell Sales and Engineering Corporation, Birmingham, Ala.; Christy Firebrick Company, St. Louis, Mo.; Harrison & Company, Salt Lake City, Utah; Pacific Abrasive Supply Company, Los Angeles, San Francisco, Calif.; Denver Fire Clay Company, El Paso, Texas; Smith-Sharpe Company, Minneapolis, Minn.

(Carborundum and Carbofrax are registered trade-marks of and indicate manufacture by The Carborundum Company)

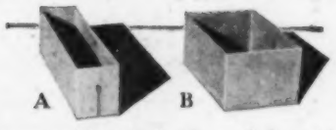
Test them yourself . . .



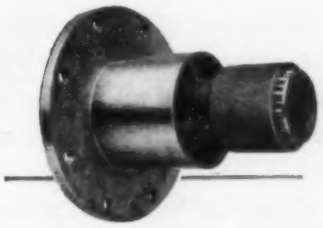
There is a Hastelloy Alloy for Your Corrosion Problem



THE Hastelloy alloys combine high strength with excellent resistance to severe corrosion. Although each alloy—A, B, C, and D—is designed for a specific service, the varying conditions found in different processes make it advisable to test them under actual operating conditions before making a final selection. Samples of the Hastelloy alloys will be furnished for test in your plant without obligation. Illustrated on this page are typical applications of the different alloys in various industries. The pump shown above is made of Hastelloy alloy B for handling hot hydrochloric acid in plastics manufacture.



These etching tanks for steel specimens are made of Hastelloy alloy B to handle hot hydrochloric acid. They are fabricated by welding from ¼-in. sheet. A is 4 in. by 5 in. by 18 in.—B is 8 in. by 6 in. by 12 in.



This $3\frac{13}{16}$-in. O. D. pilot roller bearing and mounting are made of Hastelloy alloy C for use in a chemical mixing unit. The mounting is cast in one piece.

• • •

Write for "Hastelloy High-Strength Alloys for Corrosion Resistance" which gives corrosion test data, available forms, and other useful information. Address Kokomo, Indiana or the nearest district office—Chicago, Cleveland, Detroit, Houston, Los Angeles, New York, San Francisco, Tulsa.

HASTELLOY

High-strength nickel-base alloys for corrosion resistance.

HAYNES STELLITE COMPANY

Unit of Union Carbide and Carbon Corporation

New York, N. Y. UCC Kokomo, Indiana

EXPANDING INDUSTRIES SAVE PRECIOUS TIME

BY SELECTING...

COMBUSTION ENGINEERING'S *Standardized* VU STEAM GENERATOR

All chemical and process industries plants, confronted with an immediate need for additional steam generating capacity, should consider the time-saving advantages of standardized construction which is the outstanding characteristic of the VU Steam Generator. Here is a unit that doesn't have to start from scratch. All of its time-consuming enginering work is already completed. There's nothing to delay immediate construction beyond the adaptation of its well-established design to your requirements. Thus by selecting the VU Steam Generator you can reduce materially the expired time between the date of contract and final installation.

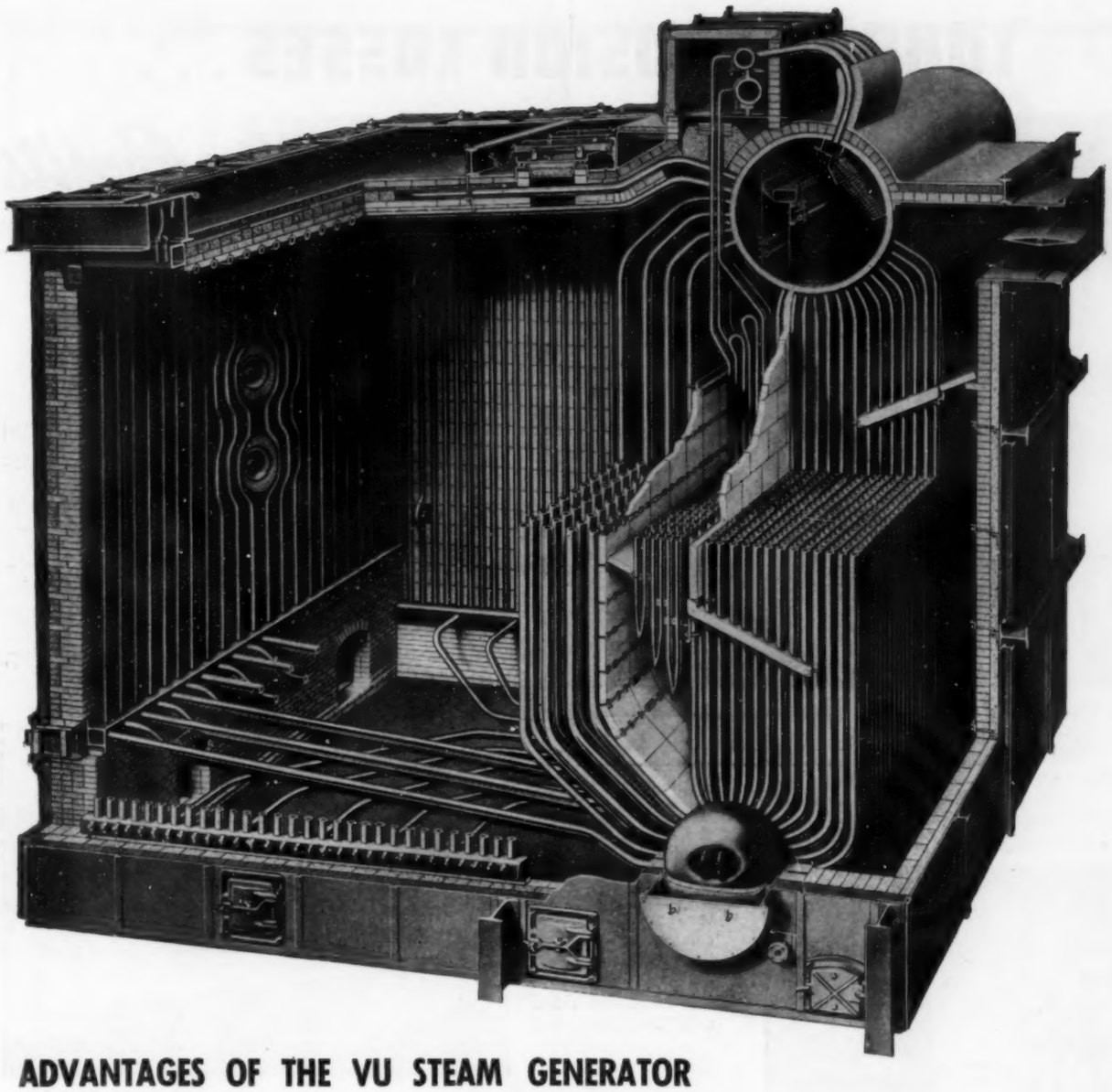
But the saving of time is only *one* advantage. Even were time not a factor, the VU Steam Generator offers exceptional value to any plant with steam requirements that fall within the capacity range — 30,000 to 300,000 lb of steam per hr. The exceptional value manifests itself in lower engineering costs, lower manufacturing costs and more simplified erection.

VU Units are operating in plants in all sections of the country. They are burning all kinds and grades of fuel. They are meeting a wide range of service conditions. These units have turned in records of operating costs which are notably low due to high thermal efficiency assured by advanced features of design and to low maintenance assured by both design features and quality of construction. Some of these design features and other advantages are briefly detailed on the right page. A study of them will reveal reasons why you, too, may expect economical steam generation.

Then, if you are pressed for time, add the time-saving features of this standardized construction and you have a compelling group of reasons for selecting the VU Steam Generator. Write for additional information.

C-E PRODUCTS INCLUDE ALL TYPES OF BOILERS, FURNACES, PULVERIZED FUEL SYSTEMS AND STOKERS; ALSO SUPERHEATERS, ECONOMIZERS, AND AIR HEATERS

COMBUSTION



ADVANTAGES OF THE VU STEAM GENERATOR

SYMMETRY

Each elemental section includes the same amount of furnace volume, of boiler heating surface and of superheater surface as any other. Gas volume, velocity and temperature, at any point from front to rear, are practically constant across the width of the unit.

ADAPTABILITY

Widely adaptable without any sacrifice of the benefits gained from standardization. It burns coal, oil, gas or any combination of these fuels. It meets widely varying conditions of load, pressure and temperature. Adaptable where space limitations are imposed.

QUALITY STEAM

The most active of the steam producing tubes enter the drum above the normal water line and discharge uniformly across the full drum length thereby reducing turbulence and assuring a stable water level and dry steam even under adverse conditions.

SUSPENSION

Overhead suspension of all pressure parts of the unit provides complete freedom of expansion in all directions to compensate for the effects of temperature changes. Abnormal mechanical stresses in pressure parts are thereby eliminated and freedom from leaky joints is assured.

STANDARDIZATION

Painstaking refinement of detail is provided at a small fraction of the original engineering cost. Standard parts and structural features, whose efficiency is confirmed by experience, reduce manufacturing and erection costs. First cost reflects the economies of standardized design.

STEEL ENCASED

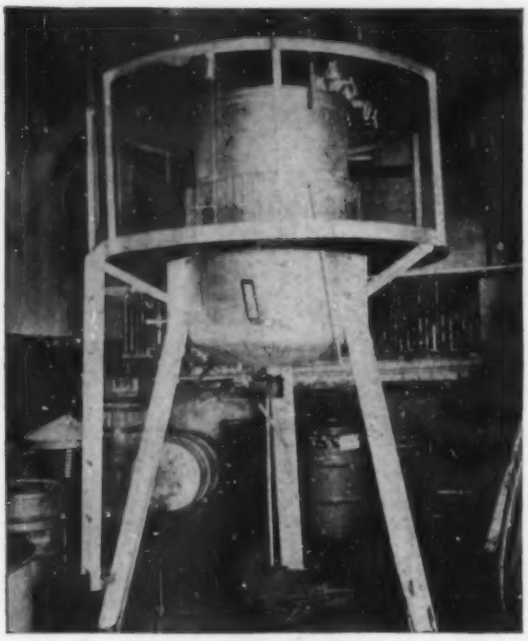
Within a permanent outer steel casing, the combination of shaped tile, refractory and 100% insulation reduce to a minimum the heat losses caused by radiation and air infiltration. A uniformly low surface temperature minus hot spots is maintained and upkeep is negligible.

A-567

COMBUSTION ENGINEERING COMPANY, 200 MADISON AVENUE, NEW YORK, N. Y. • CANADA: COMBUSTION ENGINEERING CORPORATION, LTD., MONTREAL

ENGINEERING

TURN CORROSION LOSSES . . .



Into Production Profits

with

LUKENS CLAD STEELS

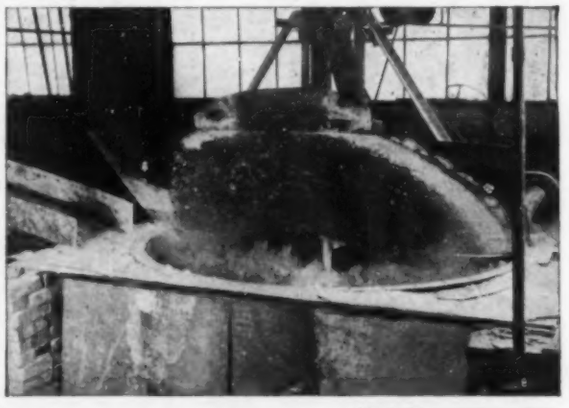
Most leading chemical manufacturers are now specifying Lukens Clad Steels—Nickel-Clad, Inconel-Clad and Monel-Clad Steels—because they:

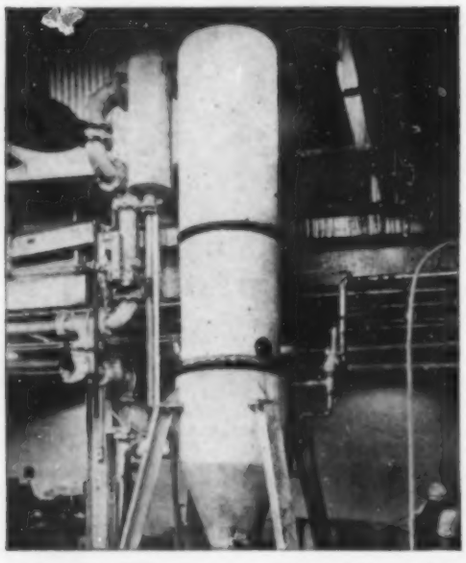
- ★ are corrosion resistant
- ★ eliminate harmful metallic contamination
- ★ improve products
- ★ save in maintenance
- ★ are easy to clean
- ★ are low in ultimate cost

For information on Lukens Clad Steels, write Lukens Steel Company, 99 Lukens Building, Coatesville, Pa.

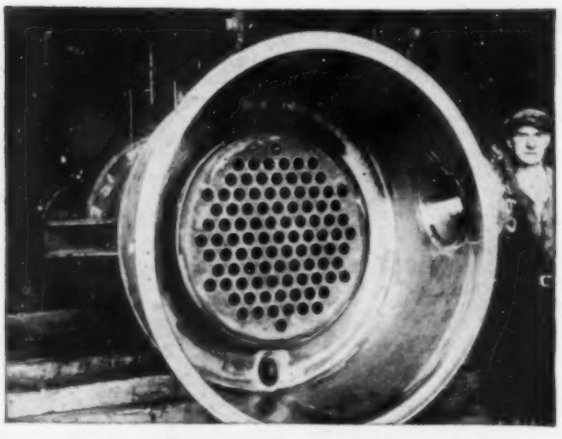
STEAM JACKETED, open top, glue processing tank, 3′ 0″ O.D., 4′ 3″ high, fabricated by Wm. Bros Boiler & Manufacturing Company, Minneapolis, Minnesota, of 15/32″ thick, 20% Nickel-Clad Steel. Steam is circulated through the jacket for cooking and water for cooling.

DRYING PAN, 7′0″O.D., 15″ deep, with a 5/16″ thick, 20% Nickel-Clad Steel bottom, used in sintering a synthetic by-product. The pan is externally heated from below and its user reports that through the better heat conductivity afforded by the Nickel-Clad bottom "production has increased three times".





INCONEL-CLAD STEEL evaporator, 5/16″ thick, 20% clad, approximately 2′ 0″ O.D. and 11′ 0″ high, used for purification by recrystallization of organic salt. The evaporator was fabricated and installed by Miller Welding Company, Toledo, Ohio.

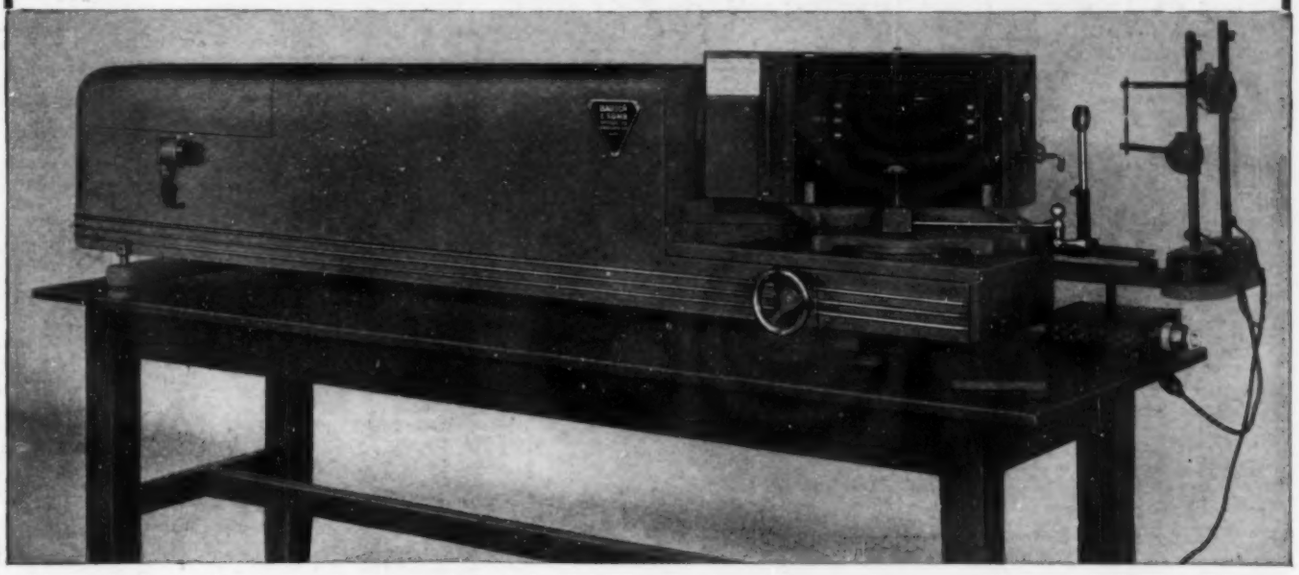


LONG TUBE VERTICAL EVAPORATOR for concentrating pectin liquor, fabricated by Swenson Evaporator Company, Harvey, Ill., of ½″ thick, 20% Inconel-Clad Steel.

LUKENS STEEL COMPANY • *World's Largest Plate Mill* • **99 LUKENS BUILDING • COATESVILLE, PA.**

Are you on the mailing list for "CLAD NEWS"? This magazine carries stories and illustrations on Lukens Clad Steels in many industries. Write for a copy. Lukens Steel Company, 99 Lukens Building, Coatesville, Pa.

B&L LARGE LITTROW SPECTROGRAPH



SIMPLIFIES BOTH QUALITATIVE AND QUANTITATIVE DETERMINATION

Equipped for every spectro-analytical problem, the Bausch & Lomb Large Littrow Spectrograph is fully capable of resolving separate lines in the crowded regions of even the most complex spectra. Some of its major advantages include the following:

1. All operating adjustments necessary can be made from the operator's position at the plate holder end of the instrument.
2. Equipped with a quartz system, the wave length range is from 2,100 to 8,000A. With glass system, the range is from 3,550 to 10,000A.
3. 4″ x 10″ or 2″ x 10″ plates may be used.
4. B&L supplementary accessories are available to provide for further increasing the results obtainable.

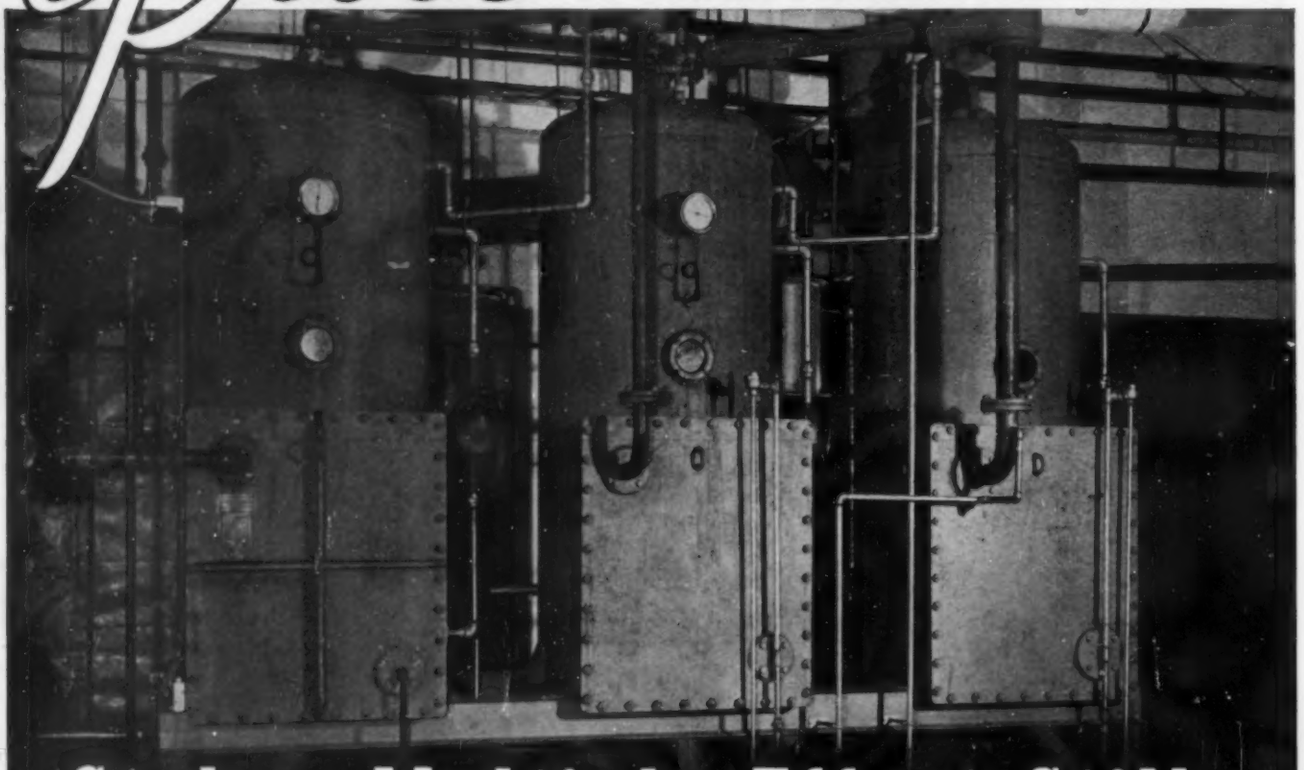
The B&L Large Littrow Spectrograph is used in many of America's leading industrial and educational institutions for both research and routine work. For complete details on this and other spectrographic equipment, write to Bausch & Lomb Optical Co., 605 St. Paul Street, Rochester, N. Y.

BAUSCH & LOMB OPTICAL COMPANY

EST. 1853

FOR YOUR EYES, INSIST ON BAUSCH & LOMB EYEWEAR, MADE FROM BAUSCH & LOMB GLASS TO BAUSCH & LOMB HIGH STANDARDS OF PRECISION

Pure DISTILLED WATER AT LOW COST



Stokes Multiple-Effect Stills

pay for themselves in 24 months or less

If you need distilled water of exceptional purity . . . if you would produce it most economically . . . consider the advantages of Stokes Multiple-Effect Water Stills.

The 300 g.p.h. Triple-Effect still shown above was recently installed by Sharp & Dohme, well-known biological and pharmaceutical manufacturers. The water produced by stills such as this is even better than that made by single-effect stills . . . distillate of the highest quality . . .

- **suitable for every purpose, even in intravenous solutions**
- **with less than 3 to 5 parts per million of total solids**
- **to meet resistance tests of from 300 thousand to as high as 600 thousand ohms**
- **with chlorine content of less than 1 part in 10 million, and to otherwise meet the most rigid specifications.**

With a triple-effect 300-gallon still like this, the yearly saving over the cost of operating a single-effect unit usually amounts to more than $3,000.

Stokes Multiple-Effect Water Stills usually pay for themselves in 18 to 24 months. Seldom will you find an investment that amortizes itself so quickly, or pays such big dividends.

We pioneered in the development of Multiple-Effect Stills . . . build them, with double-, triple- or quadruple-effects, in capacities from 50 to 5000 gallons, in steel or other metals, to meet specific water requirements and operating conditions.

F. J. STOKES MACHINE CO.

5920 Tabor Road Olney P. O. Philadelphia, Pa.

Representatives in New York, Chicago, Cincinnati, St. Louis Cleveland, Detroit, Boston

Pacific Coast Representative . L. H. Butcher Company, Inc.

F.J.Stokes **PROCESSING EQUIPMENT** FJS Est. 1895

INTRODUCTION TO A WORLD THAT *Glistens*

FROM earliest toddling days—hers is a world of sleek, gleaming wonders in sanitation, in utility and in beauty.

In the development of glistening, glazed-surface products ranging from agate marbles to enameled casings for giant electric power transformers, General Chemical Company plays a definite part. By developing one more domestic source of Fluorspar, General Chemical Company places an essential basic material at the service of the ceramic arts, enameling and other industries.

Your inquiries regarding General Chemical Company Fluorspar are invited.

GENERAL CHEMICAL COMPANY
40 RECTOR STREET, NEW YORK, N. Y.

Sales Offices: Atlanta • Baltimore • Boston • Buffalo • Charlotte (N. C.) • Chicago • Cleveland • Denver Houston • Kansas City • Milwaukee • Minneapolis • Montezuma (Ga.) • Newark (N. J.) • New York Philadelphia • Pittsburgh • Providence (R. I.) • St. Louis • Utica (N. Y.)
Pacific Coast Sales Offices: San Francisco • Los Angeles
Pacific Northwest Sales Offices: Wenatchee (Wash.) • Yakima (Wash.)
In Canada: The Nichols Chemical Company, Limited • Montreal • Toronto • Vancouver

LOUISVILLE DRYER DOES 50% MORE WORK— SAVES $3.50 PER TON!

For many years, now, you have been seeing advertisements by this company, in which we describe the drying economies of Louisville Dryers. But through "the depression," we often omitted describing *production increases*, because this particular angle was rarely a pressing problem. *Yet in many instances Louisville installations are paying an extra bonus, in increased production, which is now of vital importance.*

Take the case "blue-printed" at the right, for example. The former $60,000 batch-type dryer was turning out 6,000 tons a year at a cost of $4.65 per ton. After several pilot-plant experiments, Louisville engineers proved that a $15,000 Louisville Dryer would step up production 50%, save $3.50 on every ton of material dried, and turn out a cleaner, more uniform, better-quality product.

FORMER DRYER	
Installed cost	$60,000
Annual production (tons)	6,000
Drying cost per ton	$4.65
(Space required, 2500 sq. ft.)	
LOUISVILLE DRYER	
Installed cost	$15,000
Annual production (tons)	9,000
Drying cost per ton	$1.15
(Space required, 1000 sq. ft.)	
YEARLY SAVINGS OF LOUISVILLE DRYER, IN OPERATING COSTS ALONE	$21,000

This isn't just an isolated case. Louisville engineers are constantly finding better, more economical ways of drying wet materials. You owe it to yourself to consult Louisville. Why not write us, now? *Address:* Louisville Drying Machinery Co., *Incorporated*, 451 Baxter Avenue, Louisville, Kentucky.

ASPHALT PROCESSING WITH

DOWTHERM

THE HIGH TEMPERATURE, LOW PRESSURE, HEAT TRANSFER MEDIUM

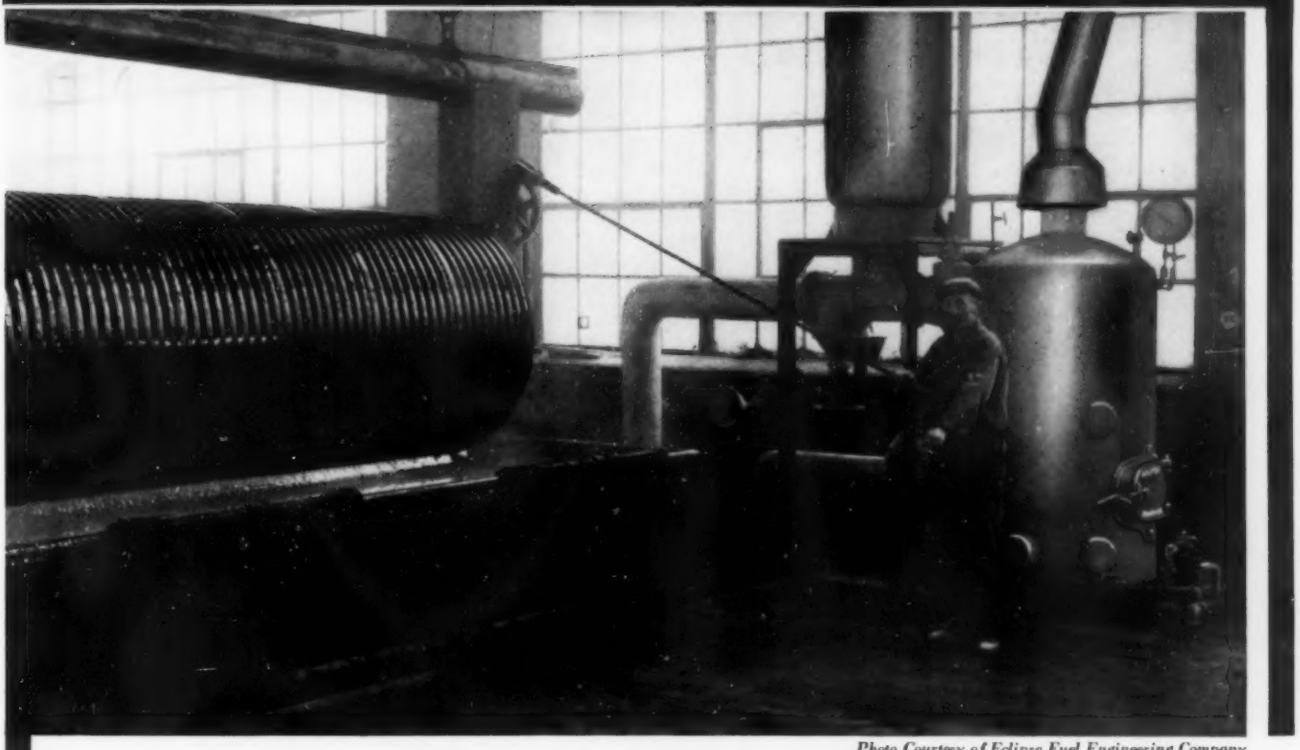


Photo Courtesy of Eclipse Fuel Engineering Company

The DOWTHERM* indirect method of heating asphalt offers many important advantages. In the installation above, for example, a boiler temperature of 450° F. enables the installation to maintain a temperature of 410° F. in the asphalt with a variation under operating conditions of only 1° F.

In addition to the exact control, available in this DOWTHERM processing operation, coking and charring no longer take place on the tank bottom, thus eliminating frequent cleanouts. No open flames are present so that the fire hazard is materially reduced. The system is flexible and varying loads can be handled, depending upon production requirements.

Thus another industry looks to DOWTHERM when controlled high temperatures are required economically at low pressures.

*Trade Mark Reg. U. S. Pat. Off.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

Branch Sales Offices: New York City, St. Louis, Chicago, San Francisco, Los Angeles, Seattle

AS THE NATION TURNS TO THE TASKS OF '41

Unclouded now by the confusions of a nation's march to the polls, are the realities of our tasks for 1941. Whether your part in these undertakings is large or small, it is more urgent than ever to assure adequate supplies of the raw materials you'll need.

If your processes involve the use of Caustic Soda, Soda Ash, Liquid Chlorine, Sodium Bicarbonate, or related products, we can help you substantially in planning for next year. Columbia products have always been noted for outstandingly high quality. Our capacity makes us one of the Industry's important producers.

But our substantial facilities can serve you most effectively only through advance planning. For this reason we urge prompt action in arranging for your next year's needs of Columbia products. Make an appointment now with a Columbia representative to discuss your requirements—and to learn how our policy makes certain that a Columbia contract means you'll get it—and get the best.

Columbia Products Include

CAUSTIC SODA • SODA ASH
SODIUM BICARBONATE • LIQUID CHLORINE
MODIFIED SODAS • CAUSTIC ASH
CALCIUM CHLORIDE • CALCENE • PHOSFLAKE

COLUMBIA
COLUMBIA CHEMICALS

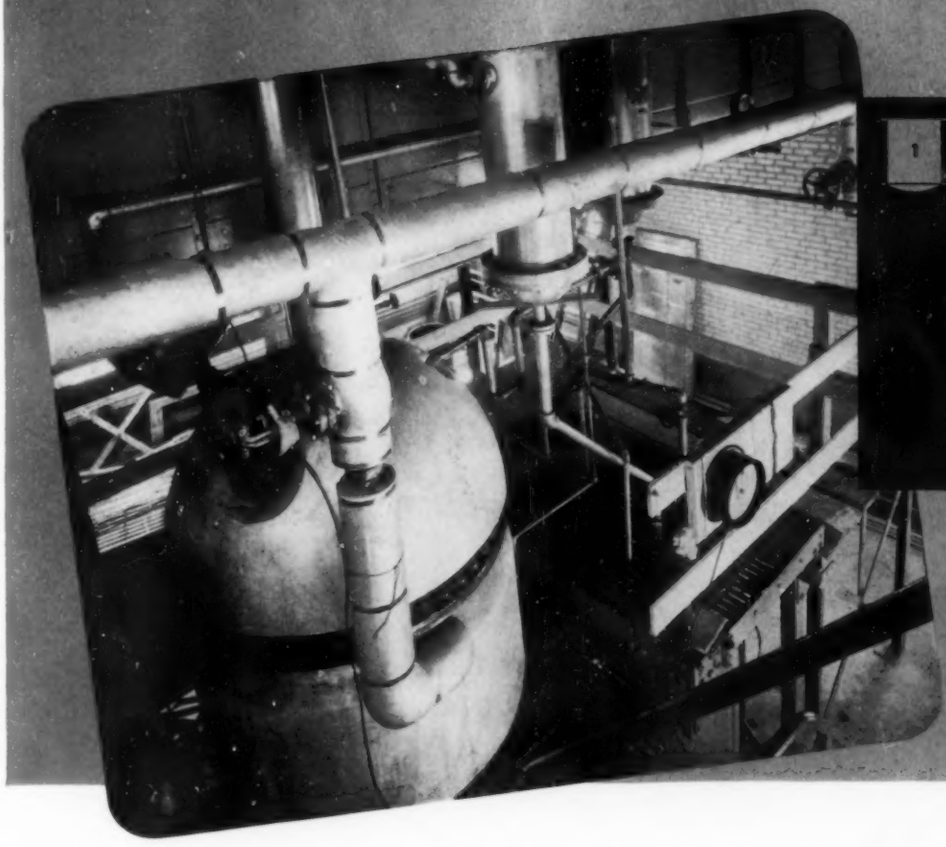
PITTSBURGH PLATE GLASS COMPANY

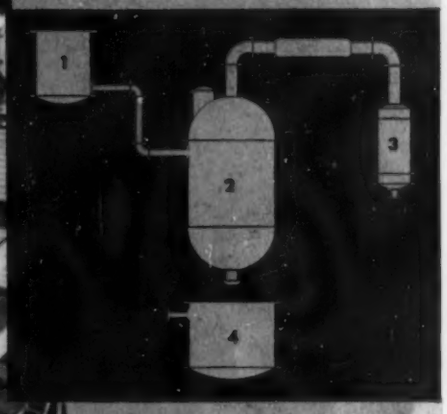
Columbia Chemical Division

30 ROCKEFELLER PLAZA, NEW YORK, N. Y.

CHICAGO • BOSTON • ST. LOUIS • PITTSBURGH • CINCINNATI • CLEVELAND • MINNEAPOLIS • PHILADELPHIA

ALUMINUM FROM START TO FINISH in the Alkyd Resin Still





1. Glycerine Storage
2. Still
3. Condenser
4. Resin Receiver

Alkyd Resin Equipment

From raw material storage tank to finished product receiver, alkyd resin equipment is made of Aluminum Alloys. This means that there is no contamination to cause discoloration. Product quality is maintained at high standards.

And, of course, the superior heat conducting property of Aluminum gives the efficiency of the system a healthy boost.

This use of Alcoa Aluminum Alloys is typical of those in many other processing plants; working at high and low temperatures, under vacuum and pressure, supporting heavy loads. In every case, Aluminum is contributing to the higher quality of products and reduced production costs. ALUMINUM COMPANY OF AMERICA, 2151 Gulf Building, Pittsburgh, Pennsylvania.

ALCOA ALUMINUM

Should a Wife tell her husband Everything?

PROBABLY a dent in the shiny fender of a new car will always be an embarrassing thing for a wife to report and explain to her husband.

But nowadays it is much easier to repair than it was a few years ago.

For phthalic anhydride has made some wonderful changes in the finish of today's new cars. Now, that "new car shine" stays shiny longer. The finish is tougher and more flexible, and doesn't so often chip when a dented fender is hammered out. Even when refinishing is necessary, it's easy to match colors . . . because the original coating is so much more resistant to sun and rain.

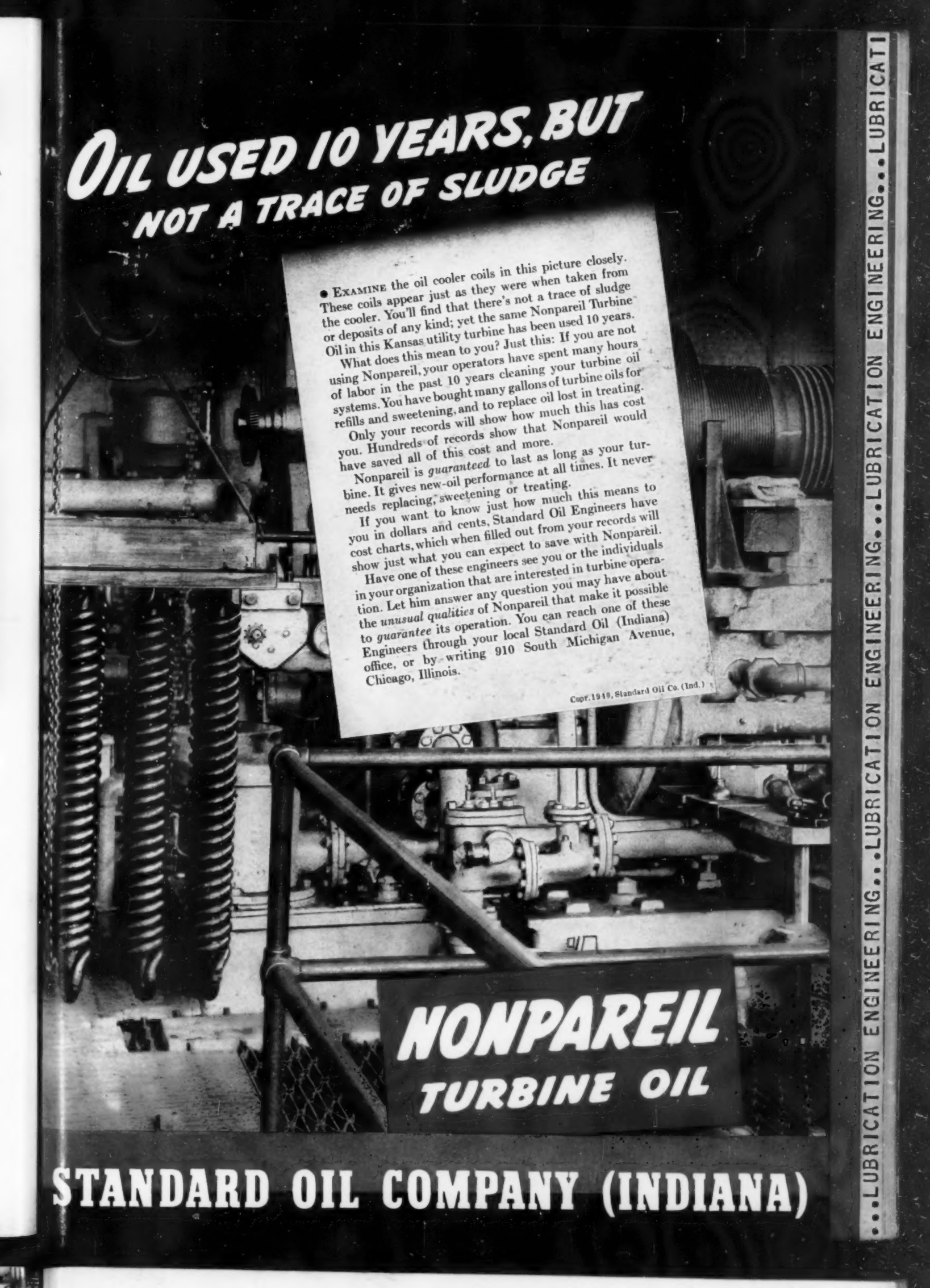
Finishes made from phthalic anhydride have brought all these advantages to the automobile industry without sacrificing in any way the quick drying qualities so necessary for mass production.

These same finishes have proved invaluable on refrigerators, radios, kitchen cabinets, washing machines. In another form, phthalic anhydride products are used in paper coatings and as waterproofing for shower bath curtains and umbrellas.

Phthalic anhydride is only one of scores of Barrett Coal-tar Chemicals which are helping industry make America a better place in which to live. Experienced Barrett chemical engineers will be glad to discuss your problems with you. Perhaps they can show you how a Barrett Chemical will improve your product or shorten your production schedule. There is no obligation. The Barrett Company, 40 Rector Street, New York, N. Y.

Barrett Chemicals **for Industry and Agriculture include: Tar Acids such as Phenols, Cresols and Cresylic Acids . . . . Naphthalene . . . . Phthalic Anhydride . . . . Cumar® (Para-coumarone-Indene Resin) . . . . Rubber Compounding Materials . . . . Coal-tar Bases . . . . Barretan® . . . . Pickling Inhibitors . . . . Light Oil Distillates . . . . Hydrogenated Coal-tar Chemicals . . . . Flotation Agents . . . . Sulphate of Ammonia and Arcadian®, *the American* Nitrate of Soda. Other Barrett basic products are Barrett Roofs . . . . Tarvia® for Good Roads . . . . Rock Wool Insulation . . . . Waterproofings . . . . Pipeline Coatings . . . . Creosote Oil for wood preservation. These are among the products which have established Barrett as *one of America's Great Basic Businesses.***

Barrett

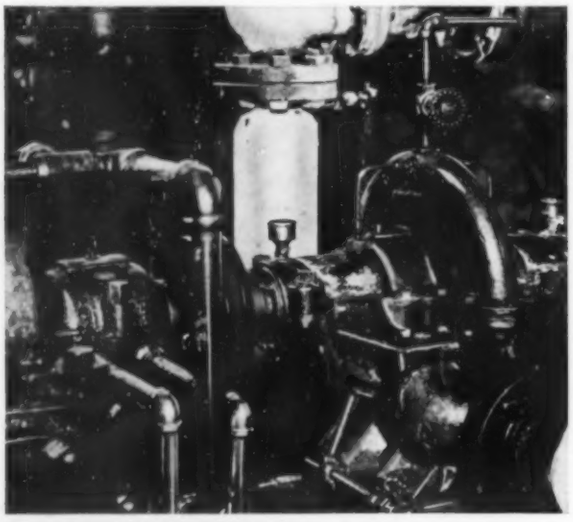

OIL USED 10 YEARS, BUT
NOT A TRACE OF SLUDGE
• EXAMINE the oil cooler coils in this picture closely. These coils appear just as they were when taken from the cooler. You'll find that there's not a trace of sludge or deposits of any kind; yet the same Nonpareil Turbine Oil in this Kansas utility turbine has been used 10 years.
What does this mean to you? Just this: If you are not using Nonpareil, your operators have spent many hours of labor in the past 10 years cleaning your turbine oil systems. You have bought many gallons of turbine oils for refills and sweetening, and to replace oil lost in treating.
Only your records will show how much this has cost you. Hundreds of records show that Nonpareil would have saved all of this cost and more.
Nonpareil is *guaranteed* to last as long as your turbine. It gives new-oil performance at all times. It never needs replacing, sweetening or treating.
If you want to know just how much this means to you in dollars and cents, Standard Oil Engineers have cost charts, which when filled out from your records will show just what you can expect to save with Nonpareil.
Have one of these engineers see you or the individuals in your organization that are interested in turbine operation. Let him answer any question you may have about the *unusual qualities* of Nonpareil that make it possible to *guarantee* its operation. You can reach one of these Engineers through your local Standard Oil (Indiana) office, or by writing 910 South Michigan Avenue, Chicago, Illinois.
Copr. 1940, Standard Oil Co. (Ind.)
NONPAREIL
TURBINE OIL
STANDARD OIL COMPANY (INDIANA)
...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATI

...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICATION ENGINEERING...LUBRICA

SUPERLA GREASE STOPS BEARING FAILURES IN BOILER FEED PUMP

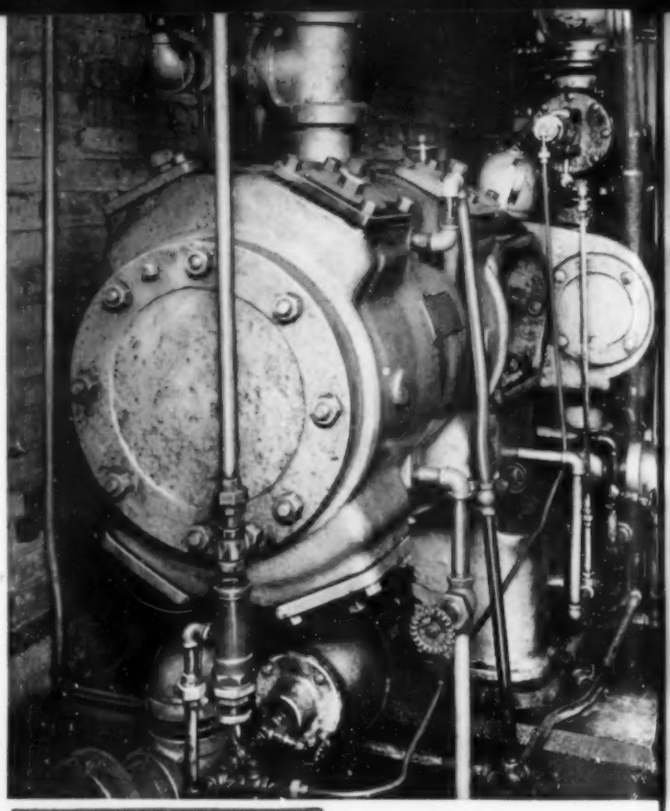
The turbine-driven boiler feed pump pictured below in a Central State institution had a large appetite for grease. A number of greases were tried, but all leaked out of the bearings rapidly and while these tests were being made bearings burned out in two instances.

After that a Standard Lubrication Engineer was called. He analyzed operating conditions: turbine speed 3450 RPM; steam pressure 210 lbs. per sq. in.; feed water temperature 215° F. He also checked the bearings for alignment and clearance. Then he recommended Superla 2X Grease. And that ended all experimenting and bearing trouble.



STANOIL SOLVES GEAR CASE TEMPERATURE PROBLEM

Small reduction gears on a motor driven adding machine were responsible for an undue number of service calls. It wasn't serious, but after long periods of continuous operation the gear case would become overheated. The manufacturer decided it was a problem for his Standard Lubrication Engineer. And rightly so, for after examining the gears the Engineer recommended a test of Stanoil 51. First it was tried in factory tests—temperatures remained normal. Then it was put in a few of the cases that had caused the service calls. Again Stanoil eliminated all overheating complaints.



STANOIL CURES UNLOADER STICKING IN COMPRESSOR

The unloader on a compressor in a Michigan refrigeration plant had to be cleaned so often that the engineer decided it would become worn out just from taking it down and cleaning it. Without this frequent cleaning it would operate only a short time without sticking, even though a special air compressor oil was being used.

Without wasting any time experimenting with other compressor oils, the engineer called in a Standard Lubrication Engineer. He knew what was needed. First, the oil should have the right viscosity and maintain it under widely varying temperature conditions. Secondly, it must be free from carbon or gum forming tendencies even after long periods of operation. That oil, the Engineer knew, was Stanoil.

Stanoil was installed. Since then, the unloader on this compressor is now cleaned once every six months and sticking is unknown.

A FAST WAY TO SOLVE YOUR LUBRICATING PROBLEMS

Because you haven't time today to spend weeks or months trying various lubricants on some troublesome lubricating job, don't neglect it. Let a Standard Lubrication Engineer help you. His first recommendation will most likely clear up the problem. Call your local Standard Oil (Indiana) office or write 910 South Michigan Avenue, Chicago, Illinois. In Nebraska write Standard Oil of Nebraska at Omaha.

Billings, Montana
Chicago, Illinois
Davenport, Iowa
Decatur, Illinois
Denver, Colorado
Des Moines, Iowa
Detroit, Michigan
Duluth, Minnesota
Evansville, Indiana
Fargo, North Dakota
Grand Rapids, Michigan
Green Bay, Wisconsin
Huron, South Dakota
Indianapolis, Indiana
Joliet, Illinois
Kansas City, Missouri
LaCrosse, Wisconsin
Mankato, Minnesota
Mason City, Iowa
Milwaukee, Wisconsin
Minneapolis, Minn.
Peoria, Illinois
Quincy, Illinois
Saginaw, Michigan
St. Joseph, Missouri
St. Louis, Missouri
South Bend, Indiana
Wichita, Kansas

YOU CAN GET STANDARD OIL ENGINEERING SERVICE

SULPHUR
in Special Cutting Oils
Speeds Production

Photograph courtesy Warner and Swasey Co.

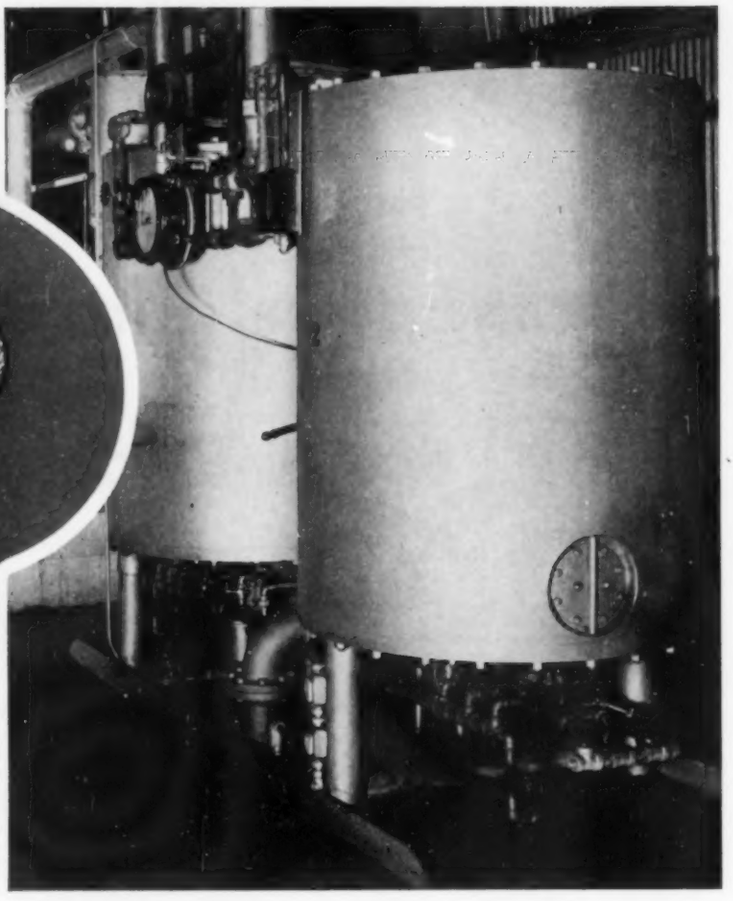
Sulphurized cutting oils have been found to be markedly superior to other types for machining the tougher metals. Sulphur adds film strength to a lubricant and it is believed that its effectiveness in cutting oils lies in its ability to act as an anti-flux to prevent the chip from welding to the tool.

Non-tarnishing Sulphurized cutting oils are doing yeoman's service in helping to turn out machines and ordnance. Production is speeded up because there is better lubrication for removing the chip from the work, better cooling action to prolong keenness of tool edge, and increased tool life by protecting it against wear by chips as they slide by.

Research has discovered many and varied uses for this versatile element—Sulphur—but none is more interesting and at this time more pertinent than its use in cutting oils which help speed production.

TEXAS GULF SULPHUR CO.
75 E. 45th Street New York City
Mines: Newgulf and Long Point, Texas

CONTROLLED ATMOSPHERES, WITH ACTIVATED ALUMINA CONTROLLING!



Activated Alumina dryers control the moisture content of *controlled atmosphere* which guards the quality of steel produced at the Vandergrift plant of Carnegie-Illinois Steel Corporation.

When steelmen talk of *controlled* atmospheres in annealing furnaces to maintain bright, polished surfaces on modern steels, they mean *controlled.* Not only must they use a gas which does not harm the surface, but in addition they must get that gas dry and keep it dry.

The trick is turned, very simply, by using Activated Alumina. Illustrated above is the equipment used in a steel mill, typical of successful Activated Alumina equipment for controlling the moisture content of gases and liquids for all purposes. Installations like this are being used to reduce the moisture content of air to 0.0000008 gram per liter, to remove as much as 600 lb. of water per hour, to handle such daily volumes as 7,000,000 cu. ft. of compressed gases, or 200,000 gallons of liquid; operating pressures are usually line pressures which go as high as 3500 psi. These dryers require at most only a few minutes attention each day, and can be wholly automatic.

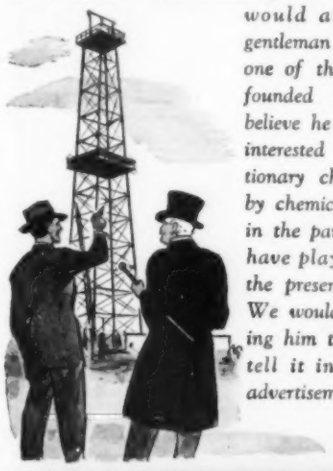
Its effectiveness and its simplicity have established Activated Alumina as a standard means of controlling moisture content of gases and liquids in many industries. Another industrial application of Activated Alumina growing in importance is its use as a catalyst and as a catalyst carrier. We shall be glad to send you information about the material and its uses. ALUMINUM COMPANY OF AMERICA (*Sales Agent for: Aluminum Ore Company*) 1910 Gulf Building, Pittsburgh, Pa.

ACTIVATED ALUMINA

AN "ALORCO" ALORCO PRODUCT

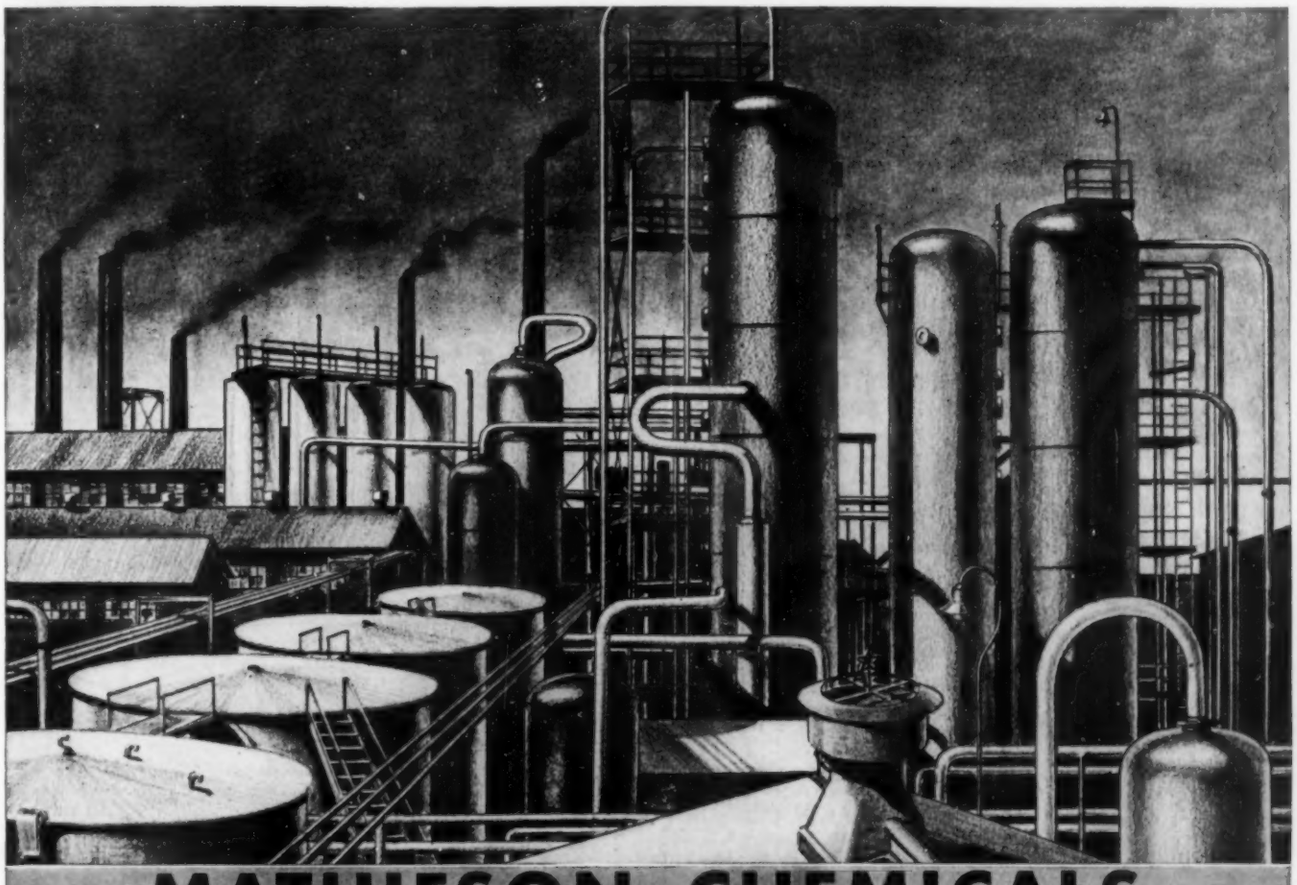
Black Gold!

Suppose someone who lived forty or fifty years ago —say one of the founders of Mathieson— could pay us a visit today. And suppose we could have the pleasure of showing him the sights of 1940, of explaining the vast changes that have taken place since the turn of the century. What do you think would amaze the old gentleman most? If he were one of the pioneers who founded Mathieson, we believe he would be most interested in the revolutionary changes wrought by chemical progress and in the part his successors have played in building the present-day America. We would go about telling him the story as we tell it in this series of advertisements.



● **You look astonished, Mr. M., as well you may. Petroleum's importance was only beginning to be appreciated in your day. You could not foresee the time when it would be one of the prime essentials of industrial civilization, and nations would put a far higher value on the possession of oil fields than on deposits of gold or diamonds.**

The story of oil is the story of our whole modern industrial age—a drama of gigantic growth and development. In the refining end of this great petroleum industry, Mathieson Chemicals play an important part—caustic soda and soda ash as treating reagents, bicarbonate of soda for fire-foam systems, ammonia for refrigeration and for combatting corrosion of equipment, chlorine and hypochlorite for sweetening distillates, for water treatment and for general sanitation. Thus Mathieson products, you'll be proud to know, are contributing in many ways to the continuing development of petroleum in its ever widening service to this nation's industrial life.



MATHIESON CHEMICALS

SODA ASH . . . CAUSTIC SODA . . . BICARBONATE OF SODA . . . LIQUID CHLORINE . . . BLEACHING POWDER . . . HTH PRODUCTS . . . AMMONIA, ANHYDROUS and AQUA . . . FUSED ALKALI PRODUCTS . . . SYNTHETIC SALT CAKE . . . DRY ICE . . . CARBONIC GAS . . . ANALYTICAL SODIUM CHLORITE

THE MATHIESON ALKALI WORKS (INC.)
60 E. 42ND STREET, NEW YORK, N. Y.

• • • *and kick back by influencing either the quality or the cost of your alkali products.*

When you use Solvay Alkalies, you can depend on their high quality . . . depend on their constant uniformity at all times. Here are a few other dependable points to consider before you place your order for alkalies:

THE RIGHT TYPE OF PRODUCT FOR THE JOB Solvay Alkalies are made in various forms to meet specific manufacturing requirements. The Solvay Products Book will give you complete information on types and strengths of Solvay products.

UNIFORM QUALITY . . . Only most modern and scientific manufacturing methods are used in making Solvay products—assuring uniform quality standards in Solvay products *every time you receive them.*

MODERN DISTRIBUTING FACILITIES . . . Three of America's largest alkali plants, located in important industrial centers and over 100 stock points assure prompt delivery and efficient routing of your orders for Solvay Alkalies.

YOUR PROBLEMS CONCERNING THE USE OF ALKALIES ARE SOLVAY'S . . . Solvay Technical and Engineering Service Division will help you get the most from your alkalies. Write to

SOLVAY SALES CORPORATION

Alkalies and Chemical Products Manufactured by The Solvay Process Company

40 Rector Street New York, N. Y.

BRANCH SALES OFFICES:

Boston	Cincinnati	New Orleans	Pittsburgh
Charlotte	Cleveland	New York	St. Louis
Chicago	Detroit	Philadelphia	Syracuse

SOLVAY SALES CORPORATION
40 Rector Street, New York, N. Y.

Please send me a copy of the Solvay Products Book which will give me complete information on all Solvay Products.

Name _____

Firm _____ *Address* _____

City _____ *State* _____ 40-1

OLDBURY

ELECTRO-CHEMICAL

COMPANY

PHOSPHORIC (U.S.P.) ACID

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PHOSPHORUS OXYCHLORIDE

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PHOSPHORUS TRICHLORIDE

Plant and Main Office:
NIAGARA FALLS, NEW YORK

New York Office:
22 EAST 40TH ST., NEW YORK CITY

DEFEATING CORROSION
AND CONTAMINATION
WITH PLATINUM-CLAD

THE extraordinary ability of platinum to resist the action of chemical agents is so well known as to need no comment and its use in large scale industrial installations would be commonplace were it not for the prohibitive cost of solid platinum for such purpose.

With the perfecting of Baker Platinum-Clad, however, its use in this field has been enormously enlarged and has engaged the attention of chemical engineers everywhere. Platinum-Clad is pure platinum or an alloy of platinum so securely bonded to a base metal body that they may be fabricated like a single piece of metal. The gauge of the platinum can be specified to suit the case. Thus a platinum surface is provided to either protect the base metal from corrosive action or to insure the product, in process of manufacture, from contamination.

Platinum-Clad is made in sheets and tubing with platinum upon one or both surfaces, and in wire. Some suggested uses are:

Kettles
Heating and Cooling Tubes
Storage Tanks for Chemicals and Essential Oils
Anodes for Electro-Chemical Processes
Tubing for Conveying Corrosive Liquids or which are to be immersed in such liquids
Gaskets
Rupture and Safety Discs

Many more will come to your mind. The subject of Platinum-Clad is worthy of your serious consideration. Why not let us send you our booklet, Platinum Metals and the Chemical Industry? You will find it highly informative.

BAKER & CO., INC.

SMELTERS, REFINERS AND WORKERS OF PLATINUM, GOLD AND SILVER

113 ASTOR STREET, NEWARK, N. J.

NEW YORK SAN FRANCISCO CHICAGO

BUY TRAYLOR GRINDING MILLS

TO INSURE YOUR PROFITS

When a Traylor Grinding Mill is put to work on a job, the owner is assured of having his work done exactly the way he wants it, to the capacity he needs, at minimum expense for operation, power and maintenance. That goes for all services in the Chemical and Process Industries, and whether there is required a ball mill, rod mill, tube mill, pebble mill, batch mill or a large compartment mill.

The reason is that the prospective purchaser's problem is carefully studied by our engineers before making recommendation of a unit, and when the order is placed, we build a machine of tomorrow's design to exactly suit his requirements.

We would highly appreciate the privilege of a discussion of your problem. Write us, saying when and where our representative shall call, and in the meantime send for our Bulletin 2103.

TRAYLOR
ENGINEERING & MANUFACTURING CO.
MAIN OFFICE AND WORKS — ALLENTOWN, PENNA., U.S.A.

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NEW STRENGTH and FORMABILITY in Lightweight Flexible Metal Tubing

REX-FLEX STAINLESS STEEL FLEXIBLE TUBING

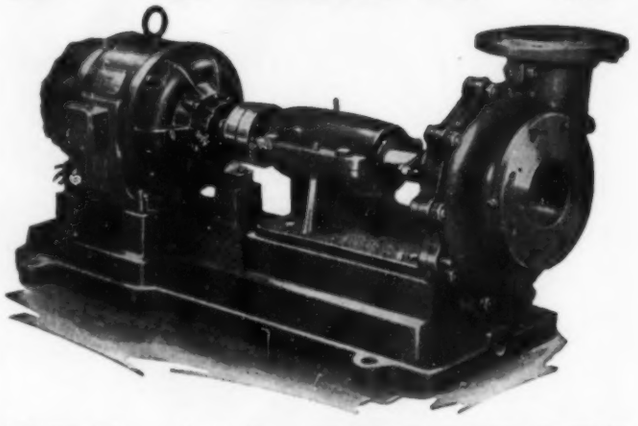
Bendable in multiple planes. Light weight. Heat and Corrosion resistant qualities. High Fatigue Value. Absolutely tight for liquids and gases. Sizes (I.D.) ⅜" to 5". Pressures to 835 p.s.i.

Available in 5 types of straight wall and corrugated tubing

Rex-Flex is manufactured in 18-8 (Austenitic) and Stabilized Stainless Steels. Also Inconel and other alloys. Data and engineering recommendations on special applications on request.

CHICAGO METAL HOSE CORPORATION
MAYWOOD, ILLINOIS

CENTRIFUGAL PUMPS



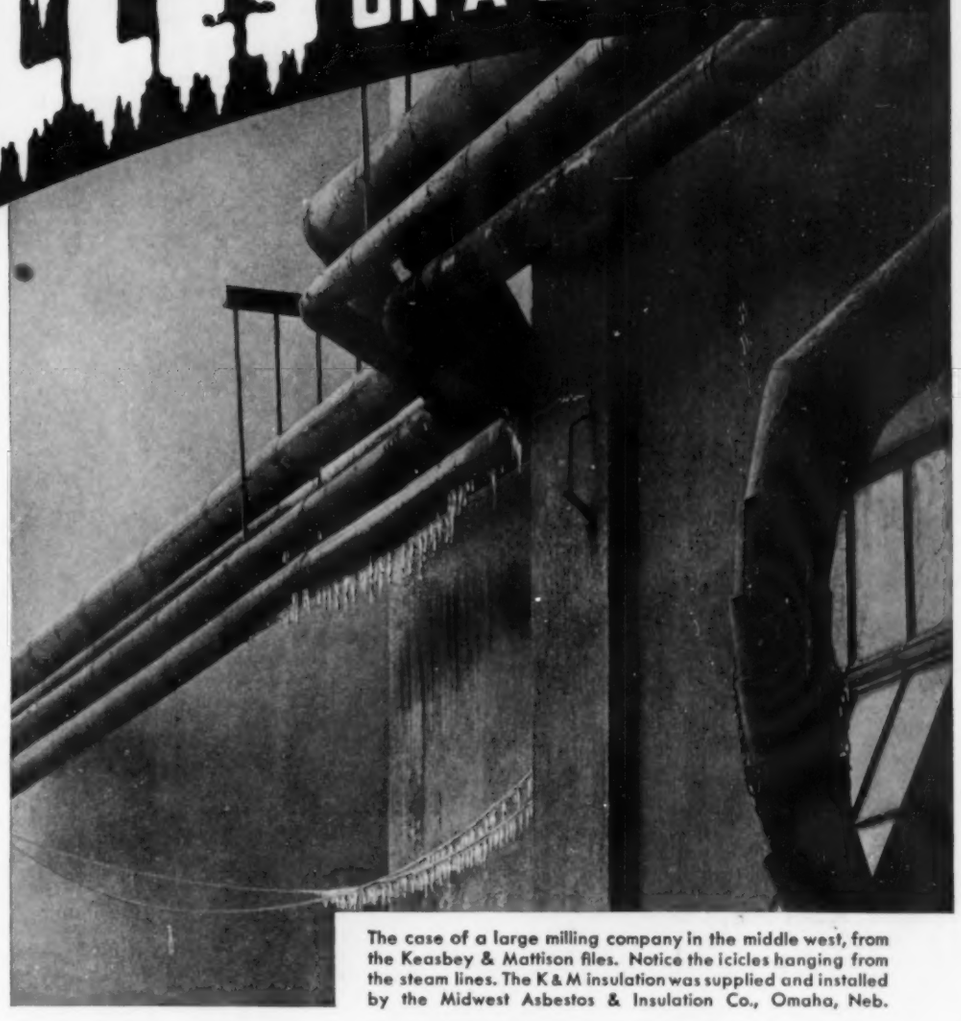
FOR ALL PURPOSES

In Stainless Steels, Acid Resisting Bronze, Nickel, Lead, or any alloy that might be required.

Frederick Pumps are designed by experienced engineers who are thoroughly familiar with conditions under which the equipment is used. A large list of chemical installations attests the merits of Frederick Pumps. *Write for Bulletin.*

THE FREDERICK IRON & STEEL CO.
FREDERICK, MARYLAND

ICICLES ON A STEAM LINE...



The efficiency of K&M insulation makes it possible

The case of a large milling company in the middle west, from the Keasbey & Mattison files. Notice the icicles hanging from the steam lines. The K & M insulation was supplied and installed by the Midwest Asbestos & Insulation Co., Omaha, Neb.

WHEN icicles grow within inches of 150 pounds of steam, you can be sure the insulation between the two is somewhere close to perfect! That's what happened last winter on these outside steam lines running from the boiler room to the plant of a large middle west milling company. It is not often that you can actually *see* insulating efficiency, but here is a case where you can.

The credit for this performance goes to Keasbey & Mattison insulations—1200 feet of K&M "Featherweight" 85% Magnesia, plus 350 feet of K&M Wool Felt. This dramatic instance emphasizes the importance of the fuel and dollar savings that this efficient K&M installation produces for its owner. Yet this is no isolated instance. Leading industries the nation over are enjoying substantial economies through the use of K&M insulation.

K&M "Featherweight" 85% Magnesia, one of the most efficient heat insulators ever developed for use at temperatures up to 600° F., is a leading product in the K&M line, which includes magnesia and asbestos materials specialized for the needs of each plant.

Keasbey & Mattison engineers, working with K&M Distributors strategically located throughout the country, can point the way to real savings in your plant, too. Write Dept. 11 for full details.

K&M "Featherweight" 85% Magnesia

"The Time-Proven Insulation"

KEASBEY & MATTISON

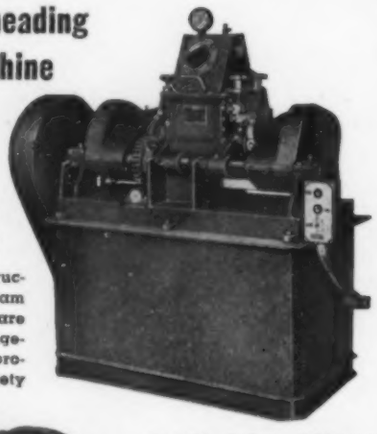
COMPANY, AMBLER, PENNSYLVANIA

DAY

MIXERS
ROLLER MILLS
SIFTERS

DAY Mogul Kneading & Mixing Machine

Experimental
Type MDA
Size 2½



These mixers are furnished in 2½ and 5 gallon sizes. They are built with jacketed tank—vacuum construction or floating steam jacketed cover. There are 8 types of interchangeable agitators that provide a wide variety mixing actions.

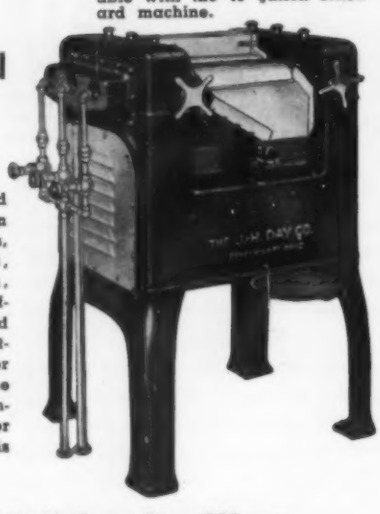
DAY Pony Mixer

Gearless Type
No. 3

This mixer is built in 5 sizes having working capacities of 40, 50, 80, 110 and 125 gallon. The cans, or tubs, revolve in the direction opposite from that of the agitator blades, providing a two-fold mixing action. This mixer can also be furnished in the standard geared type. The cam on the 40 gallon gearless machine is interchangeable with the 40 gallon standard machine.

DAY Roller Mill

Experimental
Size 5" x 12"
Type "B"



For laboratory and small batch production of paints, enamels, synthetics, lacquers, colors in varnish, also litho, gloss, offset, carton, rotary and a general line of printing inks, and other paste products. The use of roller mills in chemical industries other than paint and inks is increasing rapidly.

DAY Ro-Ball Gyrating Sifters

Built in one, two, three and four screen models providing two, three, four and five separations respectively. This screen, while making accurate separations of the material, provides a maximum capacity per square foot of screening area.

The J. H. DAY Company

CINCINNATI **OHIO**

CONSULT US ON YOUR FILTRATION PROBLEMS

WE WISH TO
EXTEND TO ALL
OUR GREETINGS
For
A MERRY XMAS
and
A HAPPY NEW YEAR

FILTRATION ENGINEERS INCORPORATED
SERVICE FE ECONOMY

858 Summer Ave., Newark, N. J.
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DROP IT IN... FORGET IT IT'S PACKED

HERCULES CARBOY BOXES

12 gallon and 13 gallon ICC 1-A
also 5 gallon size

Cut your costs—skip the excuses! Unskilled labor can pack any carboy in a Hercules *quickly*. Just drop it in—nail down the top! Hercules long-life, interchangeable cork cushions are *kind* to shipments—eliminate complaints. Save shipping weight and space, too!

Go National for ALL your packing! National Multiple Bottle Boxes—1 to 16 bottles, 1 lb. to 1 gal. Any size — any type. Send today for catalogue and price list.

SPECIALISTS IN WOODEN BOXES FOR 35 YEARS

NATIONAL BOX & LUMBER CO.
NEWARK · NEW JERSEY

Philadelphia LIMITORQUE CONTROL operates all types of valves, etc., safely, economically, from convenient stations.
Philadelphia WORM GEAR SPEED REDUCER right angle drives—vertical or horizontal. Wide range of ratios and horsepowers.
Philadelphia HERRINGBONE SPEED REDUCER for heavy loads at high speed. Single, Double, Triple Reduction, various ratios and horsepowers.
Philadelphia MOTOREDUCER The economical self-contained drive. Horizontal or Vertical types—various ratios and horsepowers.
Philadelphia GEARS All types and sizes of industrial gears. Can be supplied in all materials.

● Through elimination of baseplates and couplings between motor and reducer, the Philadelphia MotoReduceR is economical to install for many services throughout the process industries.

Its very high efficiency in operation brings further economies to industrial production—and records for trouble-free operation have saved on maintenance and continuous production problems.

These combined savings invite your inquiries for either horizontal or vertical drives . . . in a wide range of ratios and horsepowers.

Write for full engineering data and recommendations. Also, ask about the PlaneTorque MotoReduceR. It provides sure protection to itself and driven equipment, wherever overloading or jamming may occur. ●

PHILADELPHIA GEAR WORKS

Industrial Gears and Speed Reducers
Erie Ave. and G St.
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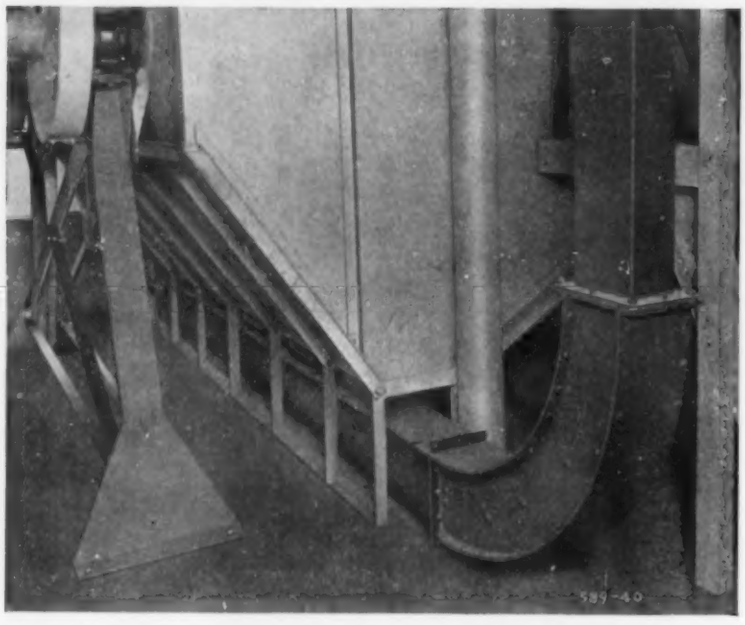
●
New York • Pittsburgh • Chicago

MASS-FLO CONVEYOR

LOW INITIAL COST—DUSTLESS



Jeffrey Mass-Flo conveyor (above) handling soy beans in large processing plant. A cross section view of same arrangement at the right.

For mass handling of a wide variety of free-flowing materials — Jeffrey Mass-Flo—in various arrangements:

I. type elevator-conveyor (illustrated)

Horizontal-inclined—Horizontal Loop boot type

and these advantages:

Self-cleaning—Self-feeding

Conveys and elevates

Operates at full or partial load

Handles material without breakage or dust

Low initial cost—low upkeep

Easy to install — small installation space

More detailed information on how the Mass-Flo can serve your handling requirements more efficiently and economically—in Catalog No. 730—send for it.

THE JEFFREY MANUFACTURING COMPANY

909-99 North Fourth Street Columbus, Ohio

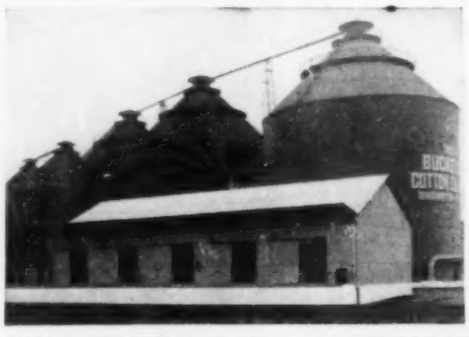
New York	Pittsburgh	Cincinnati	Milwaukee
Buffalo	Baltimore	Huntington	Denver
Boston	Cleveland	Birmingham	Terre Haute
Philadelphia	Detroit	St. Louis	Houston
Scranton	Chicago	Salt Lake City	

LOOK FOR THIS TRADE MARK—THE SIGN OF A GENUINE VIKING!

For the sake of the pump — fit the pump to the job. That's a good rule to remember regardless of what you're pumping. If your pumps are NOT large enough, they're wasting time . . . if your pumps are TOO large, they're wasting both power and motion. Viking's complete line of "stock" rotary pumps ranges from ½ GPM to 1,050 GPM. The next time you need a certain size pump to fit a certain size job, write, wire or phone Viking.

WRITE FOR BULLETIN 2400-39

VIKING PUMP COMPANY CEDAR FALLS, IOWA



Buckeye Cotton Oil Company, Memphis, Tenn.

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Careystone ASBESTOS CEMENT

CORRUGATED ROOFING AND SIDING

IF you need a new building in a hurry, either for temporary or permanent use, solve the problem with CAREYSTONE Siding and Roofing. Simply erect steel or wood frame and cover top and sides with the quickly-applied sheets of CAREYSTONE. No matter how long the need for the building may exist, this enduring material made of Asbestos and Portland Cement may be counted on for dependable service. When the building is no longer needed, it may be taken apart without damage, stored, shipped, sold, or used in other construction. CAREYSTONE offers you the advantages of low first cost, economical erection, minimum depreciation, maximum salvage. Write for catalog — address Dept. 15.

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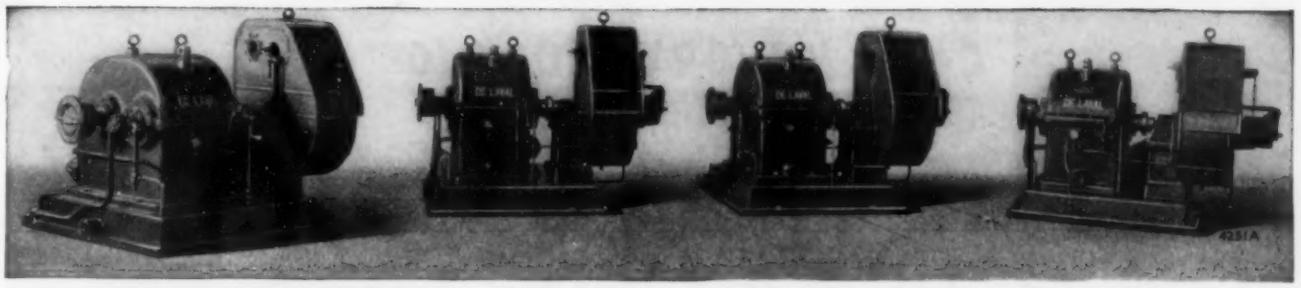
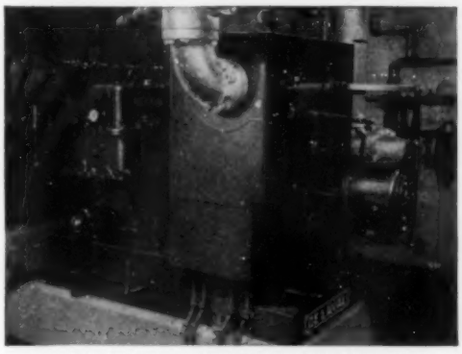
Dependable Products Since 1873

BRANCHES IN PRINCIPAL CITIES

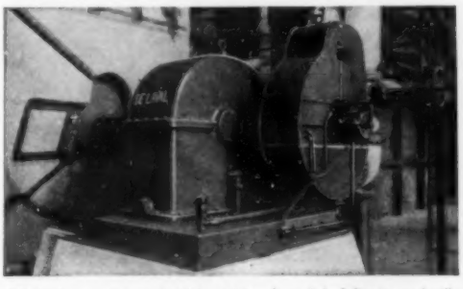


● Four velocity-stage geared turbines for induced fan drive; to use superheated steam at 475 psi.



● Velocity-stage geared turbine driving forced draft fan in paper mill.

● Velocity-stage geared turbine driving induced draft fan.



● Velocity-stage geared turbine driving forced draft fan in steel mill; using steam at 450 psi. and 750° F.; 125 hp. at 3440 r. p. m. turbine speed and 1450 r. p. m. fan speed.

Draft Fan Drives

Steam plant auxiliaries require variable speeds, particularly fan drives.

DE LAVAL GEARED TURBINES

meet such requirements in an ideal way. Speed reduction permits both turbine and driven machine to run at the speeds respectively most conducive to efficiency.

The speed of the turbine can be adjusted, either manually or automatically, by continuous variation through a wide range, resulting in a great saving of power as compared with throttling the air flow, and also giving better control.

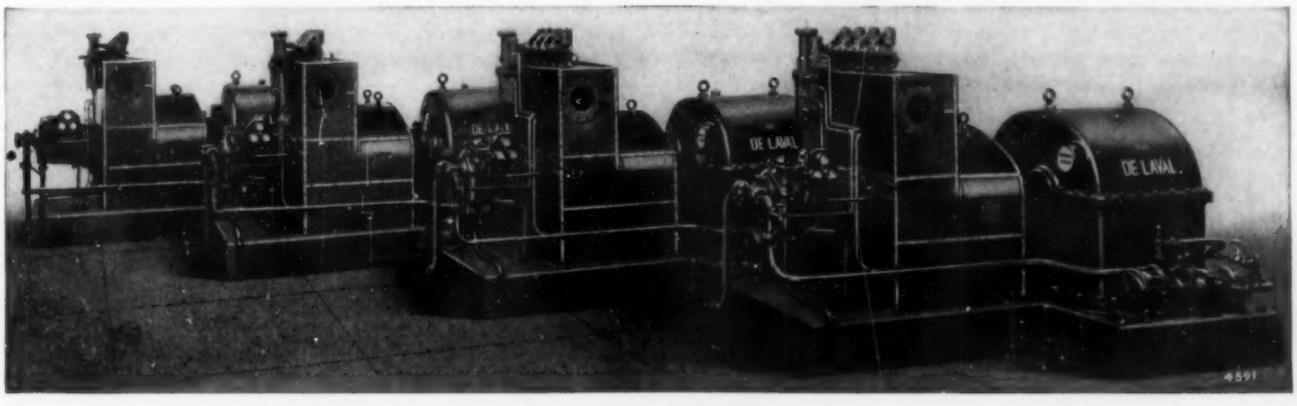
The large powers now required by draft fans, often exceeding 1000 hp., enable turbine drive to compete in economy with motor drive, if the latter is charged with its proper share of electrical losses and equipment costs.

Finally, turbine drive, besides being more flexible and in many cases less expensive than electrical drive, is VASTLY MORE RELIABLE, since it is independent of main units and electrical circuits, and so long as there is steam pressure, is always ready to run.

Write for Publication T-3519

DE LAVAL STEAM TURBINE CO., TRENTON, N.J.

● Four multistage geared turbines to drive induced draft fans; 1200 hp. each at 4750 r. p. m. turbine speed and 1080 r. p. m. fan speed.



User Experience O K's this Centrifugal for

CASE HISTORY NO. 346

Permanganate Crystals
Sulphur Crystals
Perfumes & Essences
Gelatin
Fruit juices & Pulps
Alcoholic liquors
Rayon Cake
Corn Starch
Buttons
Vegetable Ivory—ground
Soy Bean meal
Health Salts

TO CLARIFY A CHEMICALLY PURE PHARMACEUTICAL

Problem: Clarification of a pharmaceutical product. Absolute clarity and purity was a definite requirement because the product is used for injection into the human blood stream.

Solution: Centrifugal with non-corrosive, non-contaminating materials of construction. Basket with special features.

Results: Complete solution of the clarification problem and a product which passed the most rigid inspection.

IF YOU MANUFACTURE C. P. PRODUCTS

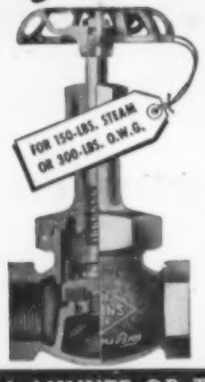
If chemical purity as well as clarity are essential to a finished product, the centrifugal almost invariably proves to be the most economical method. If you want facts and figures on the clarification of your product by centrifugal methods, send or bring a sample to R. E. Engineers. They will return it with a complete, confidential report without obligation to you.

ROCHESTER ENGINEERING & CENTRIFUGAL DIVISION
THE AMERICAN LAUNDRY MACHINERY COMPANY
114 Norwood Station — Cincinnati, Ohio

30,000 USERS CAN'T BE WRONG

A FEW PENNIES MORE *SAVE* DOLLARS IN OPERATING COST

Jenkins 106-A *Valves*

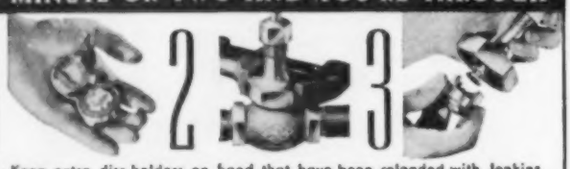


This Jenkins 106-A "Family" is revolutionary in design—from the extra convenience features, to complete interchangeability of parts. Note how the convenient slip-on, stay-on holder takes but a few simple operations to replace a disc and get "good-as-new" valve performance.

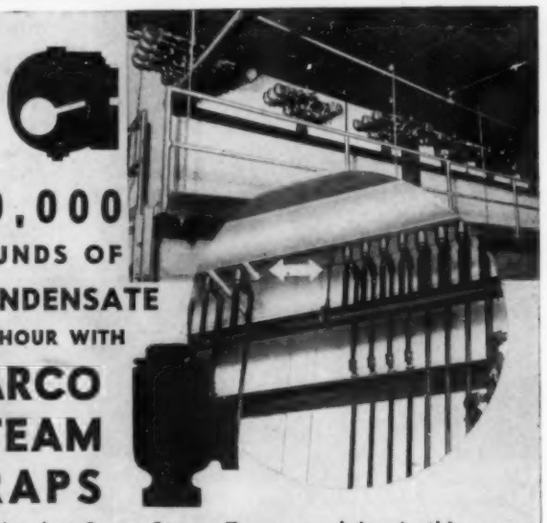
Then there is the unique way Jenkins 106-A "Family" works together—so that you can adapt valves to any service without removing bodies from the line. This interchangeability, which no other valve manufacturer offers you means faster, easier maintenance with a minimum of stock parts. Obtainable from your supply house. JENKINS BROS., 80 White St., New York, N.Y.

Write for Bulletin 189

A MINUTE OR TWO AND YOU'RE THROUGH



1. Keep extra disc holders on hand that have been reloaded with Jenkins Discs in spare time. **2.** Apply a wrench to the husky one-piece bonnet and unscrew. By raising the spindle a turn or two you will prevent the disc holder from falling off the spindle. **3.** Turn spindle all the way down and disc holder will slip off. Slip on holder containing the new disc—return trimming to the body, for "good as new" service.



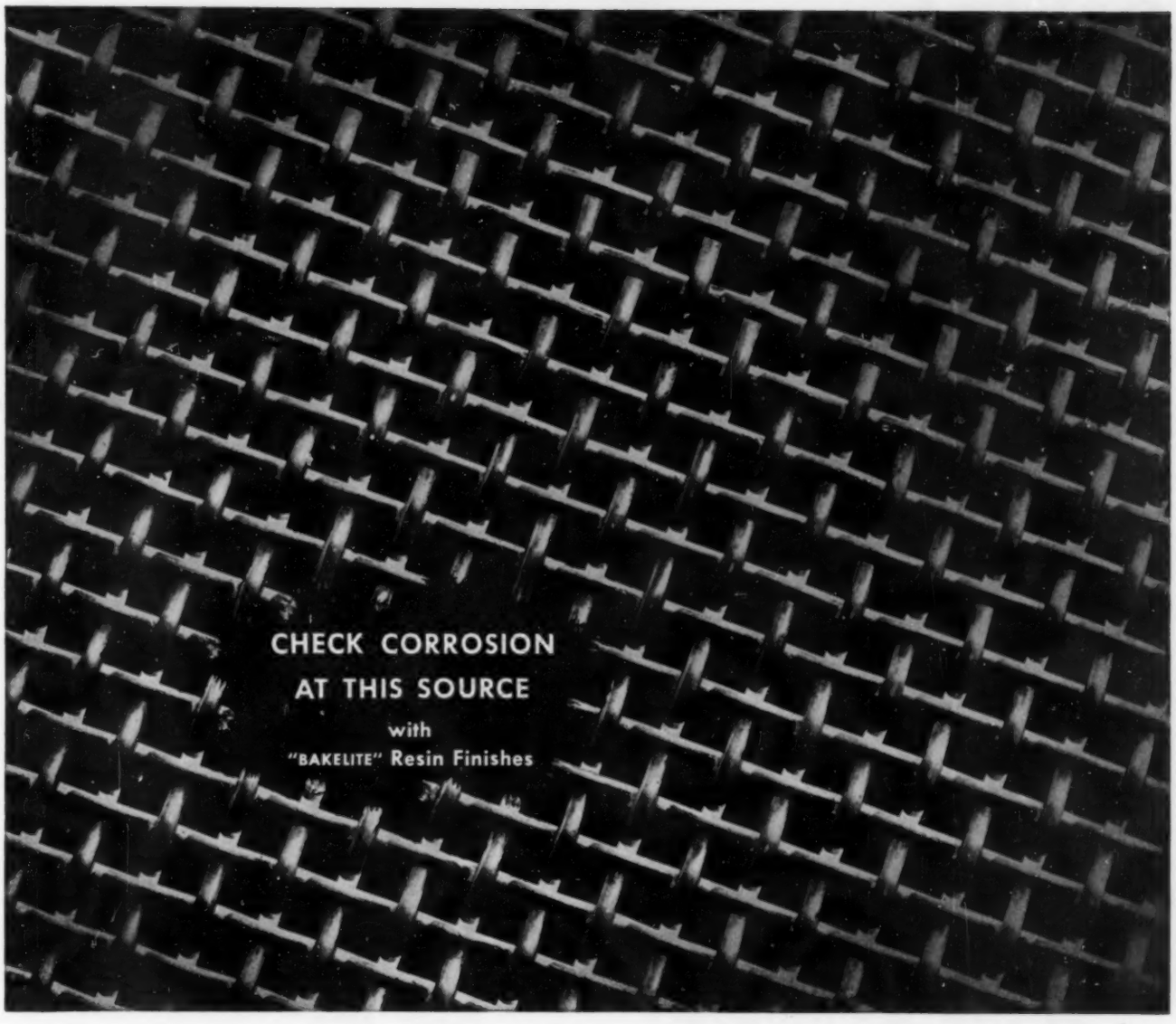
50,000 POUNDS OF CONDENSATE PER HOUR WITH SARCO STEAM TRAPS

That's what Sarco Steam Traps are doing in this one drying room of a large tape paper manufacturing plant in the Midwest. The views show a few of the 47 Sarco Float-Thermostatic Traps on the drying coils and some of the No. 9-200 Traps for individual venting of each coil. And the steam pressure varies from 10 to 130 lbs. Hundreds of other Sarco's are used in this plant—many of them for more than 10 years, 24 hours a day, 6 days a week. Sarco Temperature Controls are giving similar service in this plant. Ask for Catalog Nos. 38 and 48.

SARCO SAVES STEAM

SARCO COMPANY, INC.
183 Madison Avenue, New York, N. Y.
SARCO CANADA LTD., FEDERAL BLDG., TORONTO, ONT.

90



THOUGH it may start in one tiny spot, corrosion can rapidly spread and destroy the efficiency of wire screens, sieves, strainers and similar metal products. However, you can effectively combat such deterioration—at surprisingly low cost, with coatings of heat-reactive varnishes based on BAKELITE Resins.

Resistant not only to moisture, but also to chemicals, heat and abrasion, these modern anti-corrosive finishes are providing enduring protection for a diversity of equipment, ranging from coatings for pump impellers to linings for huge storage tanks.

Enlist the cooperation of Bakelite Research Laboratories in determining how readily these economical coatings can solve many of *your* surface-maintenance problems. Ask also for informative Portfolio 5.

BAKELITE CORPORATION
Unit of Union Carbide and Carbon Corporation
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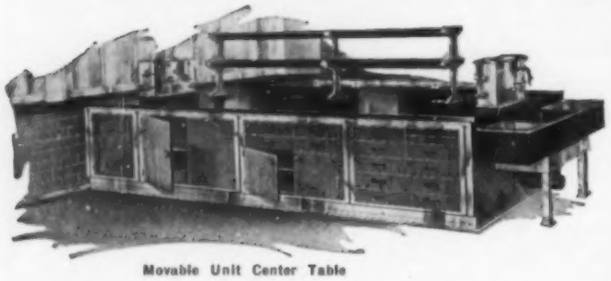
SYNTHETIC RESINS
FOR ANTI-CORROSIVE FINISHES

Quick Answers To Your Laboratory Equipment Problems



Movable Unit Center Table

The expanding defense program may suddenly tax your laboratory facilities. You will be glad to know that at Kewaunee's two great plants (Kewaunee, Wis. and Adrian, Mich.) we have the answer, (in wood or in metal) to your problem of getting the most modern, convenient and efficient Laboratory Equipment into service quickly. You pay no price penalty for Kewaunee's practical knowledge and years of experience in equipping leading Industrial Laboratories of this country. You profit immeasurably by Kewaunee's facilities for serving you promptly without ever endangering the standards of quality for which Kewaunee is famous.

We invite your inquiry.

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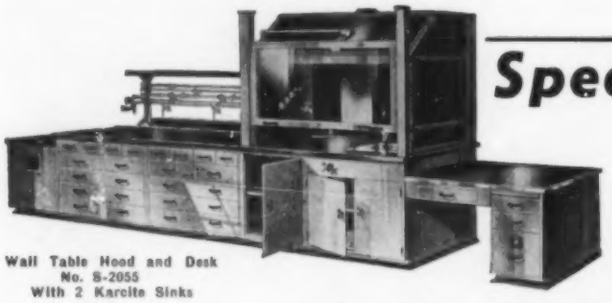
REPRESENTATIVES IN PRINCIPAL CITIES



Wall Table Hood and Desk
No. S-2055
With 2 Karcite Sinks

Specify KARCITE SINKS

(MOLDED CERAMIC)

A Kewaunee product developed in the Laboratories of Mellon Institute of Industrial Research. Molded in one piece with rounded corners and perfect slope to drain. Free from distortion—inert to solvents and mineral acids (except hydro fluoric). Will not crack or break under ordinary weight shocks and thermal shocks. Gray black color—smooth-surfaced—dull gloss finish. Lighter—stronger—easier to clean. Also distributed by most other leading manufacturers of Laboratory Furniture. So, on all orders, specify Karcite Sinks. Write for Catalog and Price List.

Karcite Sink
No. S-675

You can judge a firm by performance! Our experience in the field of elevated steel water tanks includes a complete line of tanks ranging from 5,000 to 2,000,000 gallon capacity.

We also manufacture tanks of other types for all purposes, as well as towers, standpipes, vats, boilers, etc. Let us know your needs in fabrication! *Write for "Tank Talk" No. 25-B.*

Tank Builders For Over 80 Years!

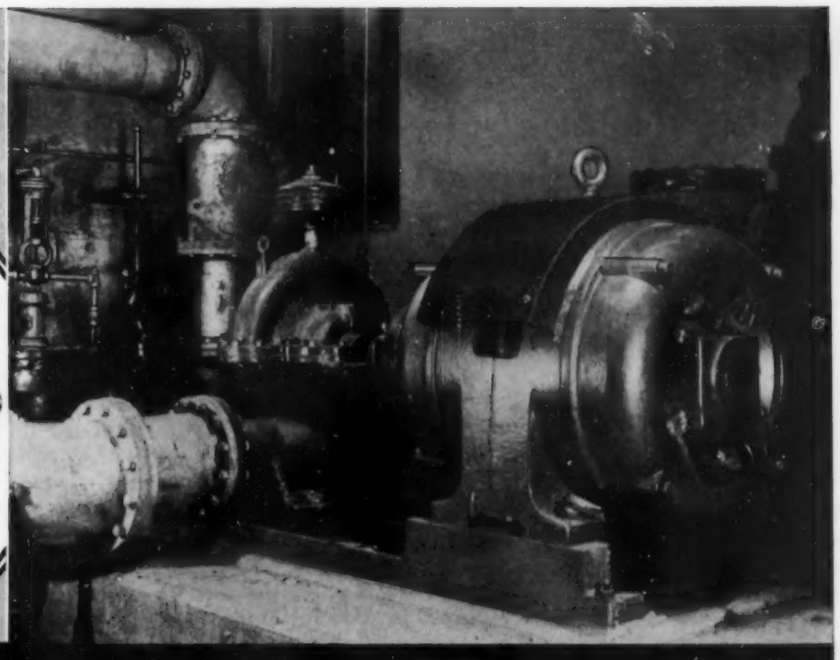
R. D. COLE MANUFACTURING CO.
ESTABLISHED 1854
NEWNAN —— GEORGIA

WATCH A DART GET ITS "SECOND WIND"

Dart Unions consistently get off to a good start, make up tight quickly, stay tight unfailingly. But the most important ability of Darts shows up best in the long run: Take down a Dart, reinstall it, and you'll find it holds the same stride, assures the same dependable tightness as the first time installed. . . . It's just plain, common-sense economy to take advantage of Darts *repeated-use*. It assures you lower cost-per-tight-joint. So next time you change or add piping, use Darts and save.

DART
UNIONS
E. M. DART MFG. CO., PROVIDENCE, R. I.

At right: 250 horsepower Century Squirrel Cage Motor driving a pump.



Century TYPE SCX MOTORS
Provide 35% Lower Starting Current

FOR

Centrifugal Pumps
Air Conditioning Fans and Blowers

It will pay you to investigate the advantages of Century Type SCX Squirrel Cage Induction Motors for applications where very low starting current is an essential requirement.

This type of Century Motor will help solve such problems as voltage fluctuations caused by the shock of heavy motor starting current—limited starter and transformer capacity—and in many applications results in a saving on expensive motor control accessories.

As an example, one Century customer using three 250 horsepower Type SCX Motors, driving large pumps, has limited his starting current to 2400 amperes per motor on a 208 volt net work line. 220 volt motors would require only 2270 amperes. Here is definite proof of the ability of Century Type SCX Motors to keep starting current low.

Century manufactures a wide variety of motor types, from fractional to 600 horsepower, all of which are equally effective in solving the numerous problems of industrial, commercial and domestic motor drives.

For many years, Century has specialized in the problems of refrigeration and air conditioning motorization. As a result, Century has developed specialized motors which have met the exacting requirements of thousands of installations in your industry. For complete information call in your nearest Century Motor Specialist — his advice is valuable and always at your service.

CENTURY ELECTRIC COMPANY
1806 Pine Street St. Louis, Missouri
Offices and Stock Points in Principal Cities

Century MOTORS

One of the Largest Exclusive Motor Manufacturers in the World

Not as it Used to be

When filter presses were needed in great number to meet the exigencies of the last war, cast iron or wood construction in a few standard designs was about all you could get.

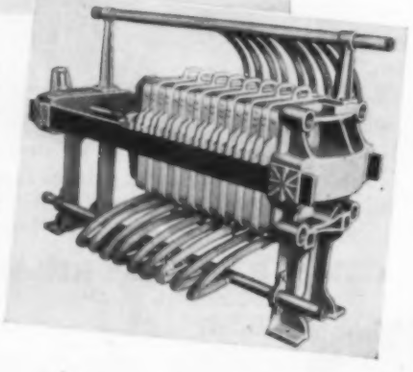
But to-day we are prepared to help the National Defense Program with hundreds of new filter press types to meet the process industries' vastly expanded and more complicated production.

Stainless steel, aluminum, nickel, bronze, rubber and plastics (to mention just a few). Filter presses with various methods of feed and discharge, with designs to give varying flow rates, with the application of special methods of heating or cooling the product during the filtration, or facilities for the use of filter aids or special construction for operation under very high pressures. The story is endless.

The point is we've kept pace, always ready to build that filter press which best ties into a particular process.

The story of the Shriver Filter Press is the story of filtration progress. Let the Shriver Catalog tell you how. Write to T. Shriver & Company, 802 Hamilton St., Harrison, N. J.

Large 30 chamber, side feed filter press of Ni-Resist for alkaline slurries.



Aluminum filter press, brine cooled, for separating winterized oils at 150 lbs. pressure.

FOR BETTER FILTRATION

Shriver FILTER PRESSES

Now...in One Step

Blending

Pulverizing

No Separating

No Bolting

Speedy and thoro pulverizing in a single step—that's the One Step Mikro-Pulverizer. One pass thru the mill generally results in a finished product—pulverized and blended; no bolting or separating necessary.

Dustless operation without fans or cyclones. Astonishing savings in time and labor. Large and small units. Performance guaranteed.

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Various Submerged Types

Taber Pumps are built in all castable-machinable alloys or iron and steel ... in a wide range of sizes and capacities.

Send for Bulletin V-735

This bulletin helpfully describes Taber Vertical Pumps. Illustrates many applications of these pumps to most any processing industry.

TABER PUMP CO. (Est. 1859)
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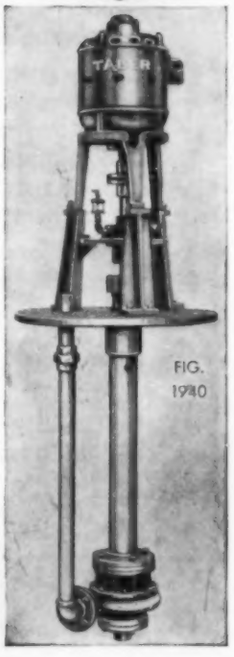


Protect Your Production Schedule with TABER Pumps

Uncle Sam...

PREPARED TO PRODUCE

WITH TAYLOR'S HELP

FACTORIES hum from coast to coast. Plant lights shine out all through the night. Sounds and sights of this nation preparing to protect our peace, our freedom, our good American way of life.

American Industry has buckled down to its biggest production job since a similar time of need, twenty-odd years ago, and is doing a grand job of it. More clothing, more food, more power, more petroleum *are* already being produced. From eastern to western oceans, vital industrial processes have been stepped up amazingly.

And they have been stepped up confidently, with the absolute assurance that swiftly increased quantity will not mean decreased quality.

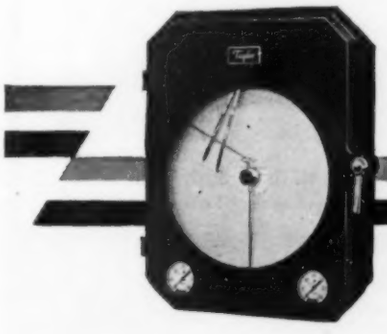
That's where Taylor comes in. Taylor Instruments are helping Industry speed up *safe* production. Taylor Instruments are helping Industry produce to more rigid specifications easily, fully, and economically.

Modern plants use Taylor Instruments—like the great new Taylor Fulscope Controller (the unique five-in-one controller!)—to help make plant operations—manufacturing, processing, or whatever they may be—*automatically* exact, *automatically* foolproof, *automatically* faster and more efficient.

Even in crisis, American Industry *can* be confident. Nowhere else in the world are finer instruments more completely guarding vitally necessary operations.

Taylor is glad and grateful for this vast, unique opportunity to help America "Be Prepared." Uncle Sam *will* be ready. The United States *is* prepared to produce. We *are* producing. Our production is our defense.

Taylor Instrument Companies, Rochester, N. Y. Plant also in Toronto, Canada.



The new Taylor Fulscope Controller helping Industry's huge preparedness program

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TEMPERATURE, PRESSURE, FLOW *and* LEVEL INSTRUMENTS

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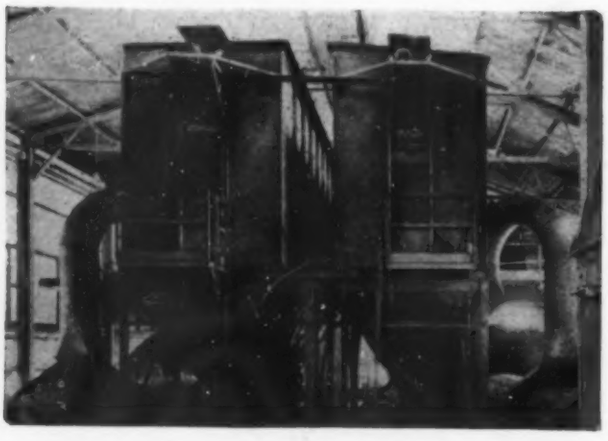

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Dust problems are complicated, and many angles must be considered in order to arrive at the best solution. After 25 years of practical experience DRACCO Engineers are experts — their sound advice is yours for the asking. Write today for further information.

• For Further Information Write •

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For a prompt quotation on fabricated steel or non-corrosive composite plate equipment, mail your specifications to Graver Tank & Mfg. Co., Inc., Dept. 20, East Chicago, Indiana.

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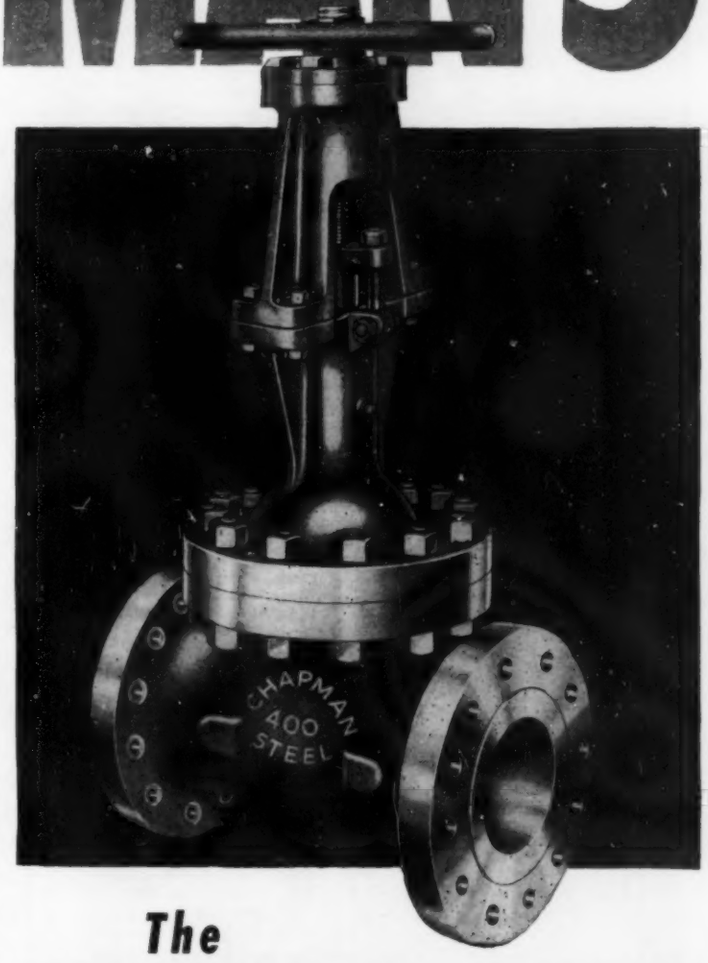
...'til you have looked over

CHAPMAN'S

line of "READY-MADE REGULARS"



Just because a valve-job looks hard to fit . . . that's no reason to jump at the conclusion that you're in for the extra expense of a special order. *Just the opposite* . . . it's a good reason to see whether you can save time and money by supplying your requirements from Chapman's standard line.

For there are numbers of Chapman *Standard* Valves that would be classed and priced as "specials" in any other line. All types of valves in iron and bronze . . . plus a complete line of valves and fittings in chromium, nickel, and molybdenum alloys. So next time you have a valve-job that's out of the ordinary . . . *see what savings there may be in store for you here.*

LATE NEWS NOTE: New Chapman Process gives Chapman steam and water valves the *exclusive advantage* of super-hardened stainless parts. This means longer valve-life . . . *greater valve-value.* Write for details today.

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A sizing manufacturer who has just installed a mixer of the style illustrated, but larger, writes: *"Your kettle is doing a good job and we are able to make sizing materials with this equipment that we were never able to make in the past and already we have noticed a great improvement in our volume of sales."*

"We particularly like the scraping arrangement" —write the soap manufacturers using this unit. They should! It cuts their batch time in half.

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MADE TRUE • STAY TRUE

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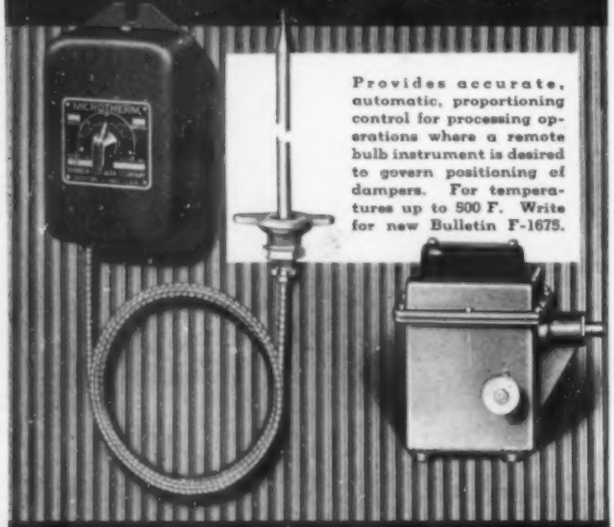
SOWERS MANUFACTURING CO., 1302 NIAGARA ST., BUFFALO, N. Y.

Bulb-type Micro-Control ...for DAMPERS!



Provides accurate, automatic, proportioning control for processing operations where a remote bulb instrument is desired to govern positioning of dampers. For temperatures up to 500 F. Write for new Bulletin F-1675.

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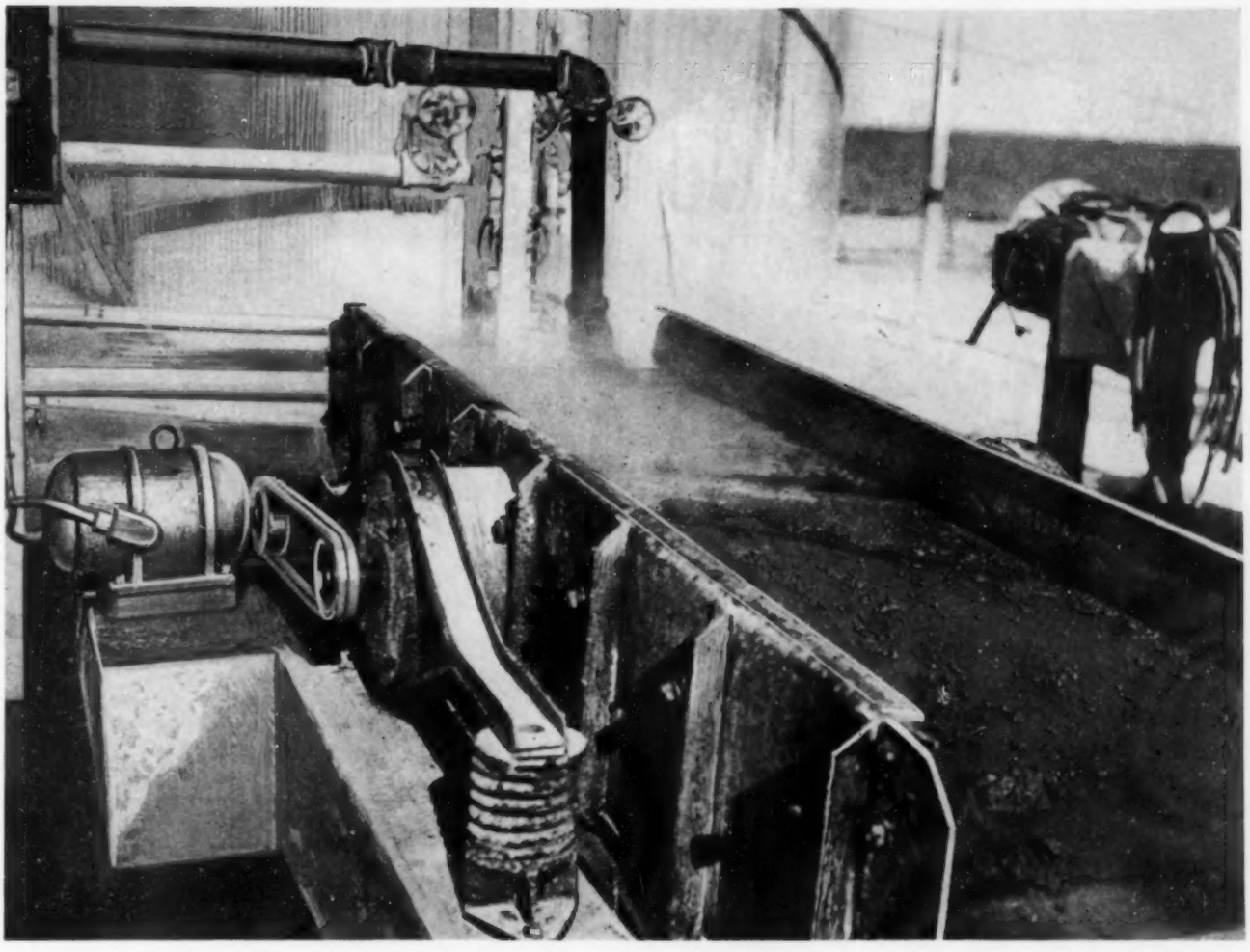
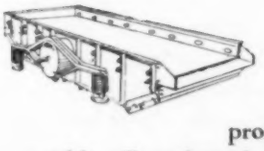
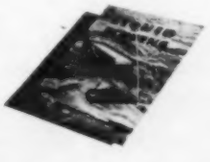


SOLIDS OUT OF LIQUIDS
THE ROBINS WAY



The Robins method of separating solids from liquids by rapid vibration over a fine screen surface has proven most effective and efficient. It has improved product, reduced process cost and cut down equipment investment in fish and vegetable oil reclamation, separating cement slurry, dewatering of rubber in process, and in other dehydrating operations in the chemical industry. Robins Engineers will gladly study your processing operation and quote you facts and figures on separating solids from liquids THE ROBINS WAY.

Send for bulletin No. 107 "Liquid Screens". It shows photographs of screens in actual use and lists standard sizes. Special screens are available for special purposes.



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They Cut Through Foreign Matter

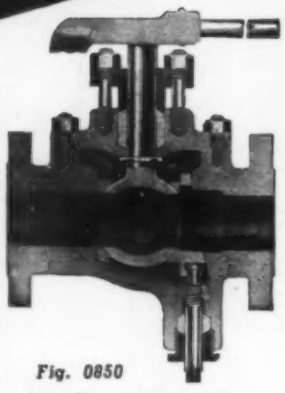

Fig. 0850
250 lbs. steam pressure

The shearing action of the rotating ball plug in Sphero Valves cuts through scale or thick viscous materials as it revolves when opening or closing. This, and the perfect seating of the ball, assures a tight, leak-proof seal.

The round portway in the plug gives an opening the same size as in the pipe and reduces pressure loss.

Wear on the seat rings is reduced to a minimum by the rotary movement of the ball because they are not in contact with the flow when valve is wide open or closed.

Fairbanks Sphero Valves are easier and quicker to operate. Working parts can be renewed on the line.

Other features which recommend them for blow-off purposes and services where a full flow, quick-acting valve is required, are explained in catalog No. 21. Write for a copy.

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Fairbanks Sphero Valves

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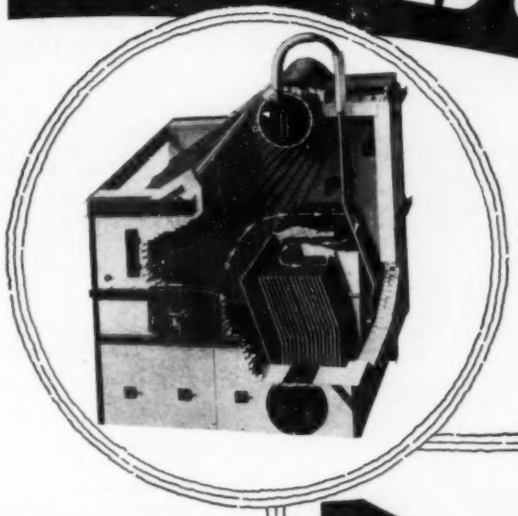
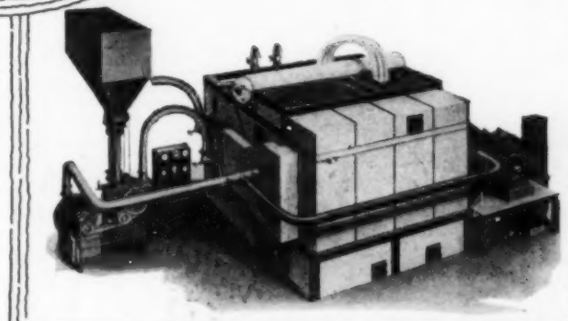


Path of gases through slag screen, across large tubes and superheater in first pass, and smaller tubes in the second and third passes.



B&W Integral-Furnace Boiler, a modern, complete unit adaptable to small plants as well as to those of moderate size.

CO.	YEAR AND NUMBER OF UNITS ORDERED							
	'33	'34	'35	'36	'37	'38	'39	'40
A							2	3
B				2			3	
C		1		1				
D	2			1				
E		2					1	
F			2		1			
G					4		2	2
H			1			2		
I				2				2
J				5	2			3
K				1	1			
L					1			1
M					1		1	
N			2			1		
O			1	1	1		1	
P			1				1	
Q					2	1		
R				1			1	
S			1				1	
T	3	1	2		1	2	2	2
U				1			1	1
V				2				1
W							2	3
X			1		2			
Y				3	4	1	1	
Z			1	1				
AA	3		1			1		1
BB				2				2
CC							2	12
DD							2	2
EE							2	1
FF							2	1

Thirty-two industrial companies and subsidiaries who bought B&W Integral-Furnace Boilers have ordered additional units of the same type. The reorders exceed the total of the original purchases by 54 per cent.

The initial orders were placed on faith in B&W engineering and ability and willingness to make every unit perform as expected. Each repeat order was founded on the owner's experience with the Integral-Furnace Boiler itself, a unit that has demonstrated its ability to meet the ultimate test—satisfactory performance.

Owners of these modern B&W Boilers (more than 275 are in service) know that, all costs included, the B&W Integral-Furnace Boiler produces the most steam per dollar.

For detailed description of B&W Integral-Furnace Boilers, ask for Bulletin G-17-A.

The Babcock & Wilcox Company, 85 Liberty St., New York, N. Y.

G-192

BABCOCK & WILCOX

Editorial Reprints and Supplements for the Chemical Engineer's Data File

FLOW SHEETS

A. "Chem. & Met.'s Chemical Engineering Flow Sheets." Third Edition. Revised and Enlarged. Published April 1940. 128-page book including 120 flow sheets of process industries. Each flow sheet on a separate 8½x11 in. page, printed one side only. Pages lie flat when opened ..... **Price $1.25**

MATERIALS OF CONSTRUCTION

K. "Chemical Engineering Materials of Construction." Reprinted from September 1940 issue. 16-page report on materials used for construction of chemical process equipment, supplemented with a 31x44-in. wall chart. The report emphasizes corrosion resistance ..... **Price $0.50**

B. "Data Sheets on Materials of Construction, 1938-39 edition." Reprinted from November 1938 issue. 38-page booklet with physical properties and chemical compositions for more than 800 corrosion-, heat- and abrasion-resistant materials used in construction of process equipment. Trade names and manufacturers are given ..... **Price $0.25**

REPORTS

C. "Chem. & Met. Report on Plant Lighting." Reprinted from January 1940 issue. 8-page engineering study of problem of lighting as related to chemical plants. Includes tables for minimum standard illumination and fire-hazard properties of chemicals ..... **Price $0.25**

D. "Chem. & Met. Report on Raw Materials." Reprinted from February 1940 issue. 32-page study on market and economic factors in chemical industry. Includes annual review statistics for 1939. Illustrated with charts and graphs in color. Also includes 3-page wall chart "A Decade of Chemical Progress in the United States, 1929-1939." ..... **Price $0.25**

F. "Opportunities in the Pulp and Paper Industry." Reprinted from April 1940 issue. 8-page report on kinds of jobs available, lines of promotion, and unsolved problems of the industry ..... **Price $0.25**

H. "Chemical Engineering Opportunities in Petroleum Refining." Reprinted from June 1940 issue. 8-page report on the work, salary and chances of advancement of the chemical engineer in the petroleum industry ..... **Price $0.25**

I. "Mechanical Power Transmission." Reprinted from July 1940 issue. 8-page report which indicates what types of equipment are available and how they are used ..... **Price $0.25**

J. "Measurement and Control of pH." Reprinted from August 1940 issue. 8-page report on a subject which is progressing rapidly because of the increasing number of industrial applications and installations ..... **Price $0.25**

L. "Chemical Plant Safety and Fire Protection." Reprinted from October 1940 issue. 8-page report on causes of accidents and personal injuries in the chemical process industries and means for their avoidance ..... **Price $0.25**

M. "Chemicals in the National Economy." Reprinted from November 1940 issue. 16-page report on how American chemical industry is serving the National Defense ..... **Price $0.25**

N. "Maintenance in Chemical Process Industries." Reprinted from December 1940 issue. 8-page symposium on maintenance, a subject of increasing interest to chemical engineers and importance in the National Defense Program ..... **Price $0.25**

MISCELLANEOUS

O. "Public Relations for Process Industries." Reprinted from October 1938 issue. 16-page presentation setting forth facts about chemical industry—jobs, money, purchases, sales, services—and how they may be used in an effective public relations program ..... **Price $0.25**

P. "Process Equipment Design." 48-page reprint from May 1939 issue discussing fundamentals and practice of chemical engineering "Design for Operation." Contains 15 articles by 14 authors ..... **Price $0.50**

S. "Temperature Conversion Tables." By Albert Sauveur. One sheet with Interconversion Tables and Chart for Units of Volume and Weight, and Energy on the back ..... **Price $0.10**

ARTICLES

Reprints of the following articles are available. As long as the limited supply lasts, they will be sent gratis upon receipt of a stamped, self addressed envelope.

T. "Tremendous Trifles." By Chester H. Penning. 4-page article from February 1939 issue.

W. "Explosions That Weren't Planned." By Ernst Berl. 4-page article from April 1940 issue.

Y. "Alkali-Chlorine Developments." By R. L. Murray. 5-page article from June 1940 issue.

Z. "What You Can Do For National Defense." By Major M. E. Barker. 2-page article from July 1940 issue.

TT. "Leather Cloth From Chemicals." By Melvin E. Clark. 4-page article from August 1940 issue.

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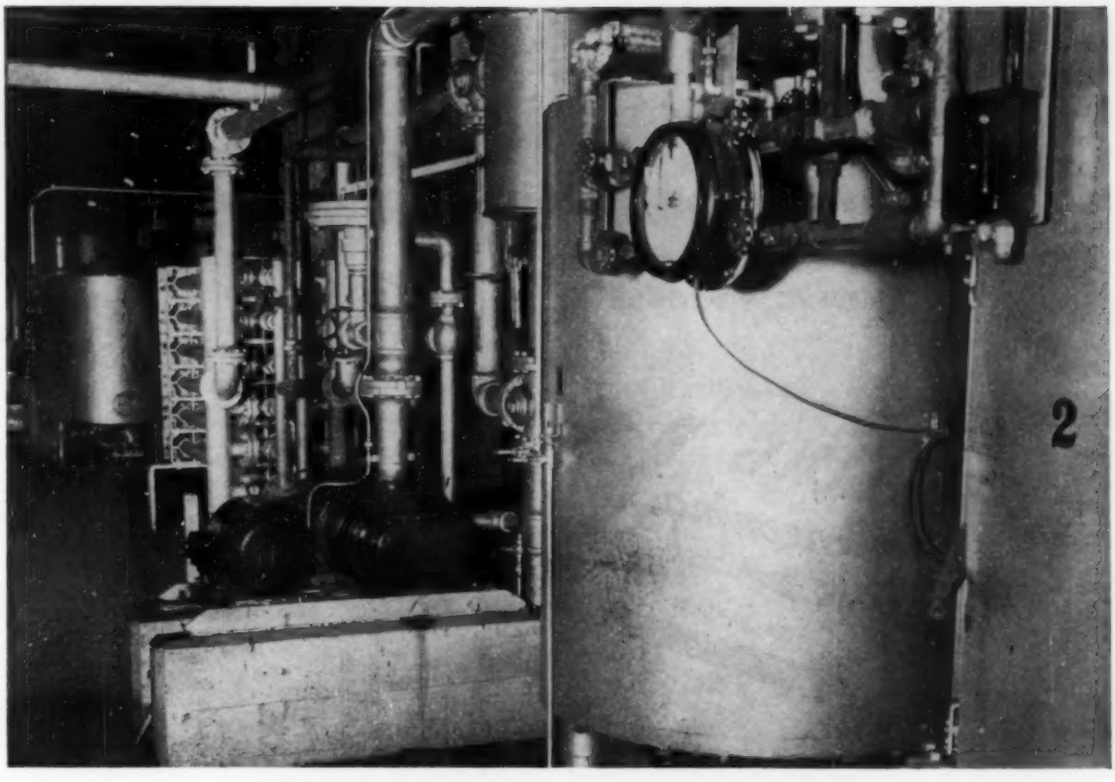

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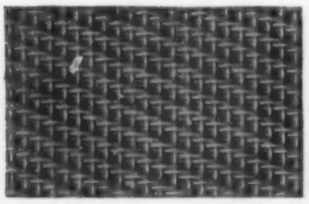

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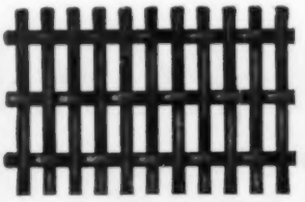
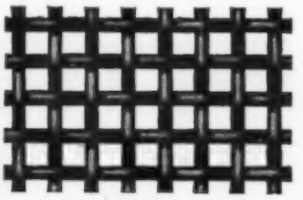


Oblong Mesh Wire Screen



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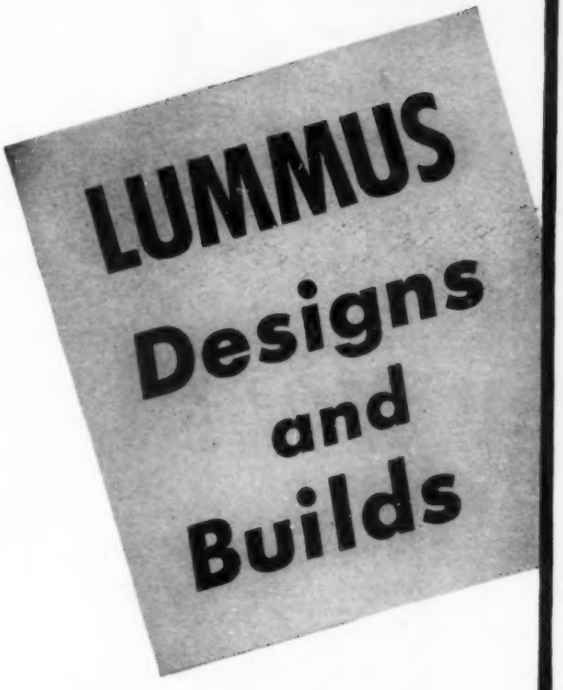

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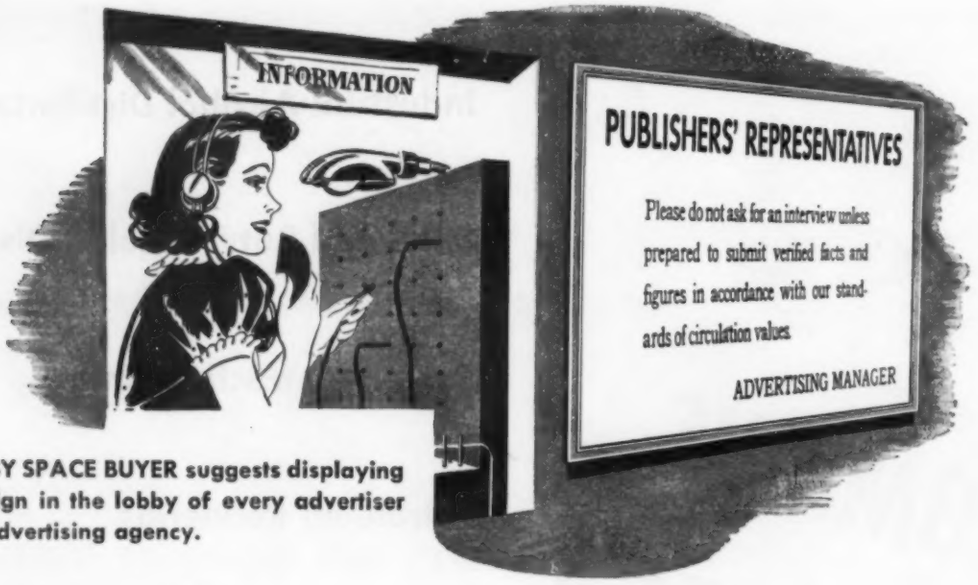

INFORMATION
PUBLISHERS' REPRESENTATIVES
Please do not ask for an interview unless prepared to submit verified facts and figures in accordance with our standards of circulation values.
ADVERTISING MANAGER

A BUSY SPACE BUYER suggests displaying this sign in the lobby of every advertiser and advertising agency.

Well—why not?

THE days of blind space buying are over. To ask an advertiser to select media on the basis of unsupported facts and figures is like asking him to sign a blank check.

Today advertisers have definite standards for circulation values. They want to know, by these standards, how much circulation a publication has, where it goes, how it was obtained, how much the readers paid and many other facts that bear on the advertising value of a business paper. With these facts, verified, advertisers can select media intelligently and buy space with assurance that they will get what they pay for.

To cooperate with advertisers and tell our circulation story by their own standards we belong to the Audit Bureau of Circulations, a cooperative organization of advertisers, advertising agencies and publishers. Our A. B. C. report giving complete and audited information about our circulation is the advertisers' assurance that their advertising investments are protected by known, verified values.

A. B. C. PROTECTS YOUR ADVERTISING

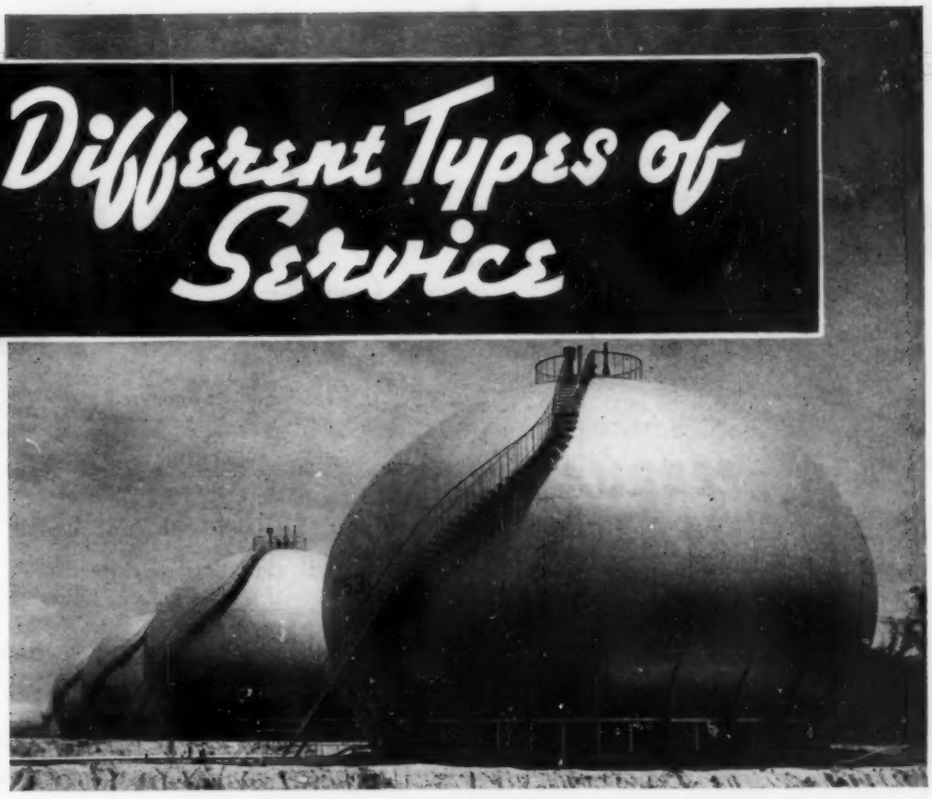
Paid subscriptions, renewals, evidence of reader interest, are among many facts in A. B. C. reports that are definite guides to effective media selection. When you buy space in A. B. C. publications your advertising is safeguarded by audited circulation. Always ask for A. B. C. reports.

CHEMICAL & METALLURGICAL ENGINEERING

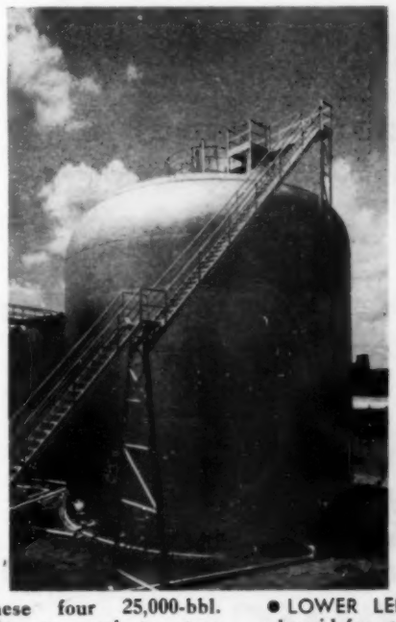
"One of Industries Great Papers"

A. B. C. = AUDIT BUREAU OF CIRCULATIONS = FACTS AS A MEASURE OF CIRCULATION VALUES

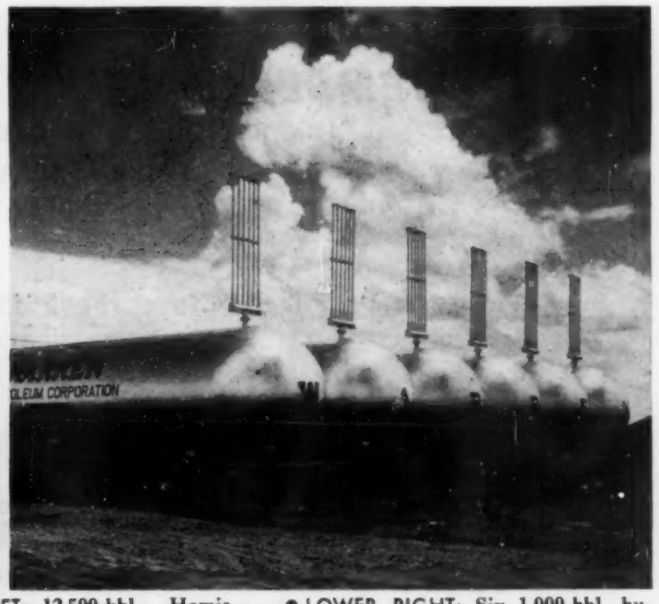
for 3 Different Types of Service



★ The tanks illustrated on this page provide facilities for storing three different oil products under pressure. Many other liquids and gases can be handled and stored advantageously in pressure containers. We build cylindrical, spherical and spheroidal structures in standard capacities from 1,000 to 120,000-bbls. for 2½ to 250 lbs. per sq. in. pressure. Also special designs and flat-bottom or elevated storage tanks. Write our nearest office for estimating figures.



● ABOVE: These four 25,000-bbl. Hortonspheroids are used to store natural gasoline at 15 lbs. pressure.



● LOWER LEFT: 12,500-bbl. Hemispheroid for storing high gravity motor fuel under 2½ lbs. pressure.

● LOWER RIGHT: Six 1,000-bbl. butane tanks at a marketing terminal. The operate at 80 lbs. pressure.

CHICAGO BRIDGE & IRON COMPANY

Chicago	2124 McCormick Bldg.	Philadelphia	1625-1700 Walnut Street Bldg.	Houston	2919 Main Street
Detroit	1503 Lafayette Bldg.	Cleveland	2220 Rockefeller Bldg.	Tulsa	1623 Hunt Bldg.
New York	3318-165 Broadway Bldg.	Birmingham	1510 North Fiftieth Street	Los Angeles	1405 Wm. Fox Bldg.
Boston	1503 Consolidated Gas Bldg.	Dallas	1405 Liberty Bank Bldg.	San Francisco	1022 Rialto Bldg.

PLANTS IN BIRMINGHAM, CHICAGO AND GREENVILLE, PA. *In Canada:* HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.

Announcing

CHEM & MET'S 4 THEME ISSUES

for 1941—

FEBRUARY:

The 3rd "FACTS and FIGURES of AMERICAN CHEMICAL INDUSTRY"—an annual statistical review.

MAY:

"CHEMICAL ENGINEERING UNIT OPERATIONS and EQUIPMENT"—a critical study of performance, specifications, and policies regarding depreciation, obsolescence and replacement.

SEPTEMBER:

"CHEMICAL ENGINEERING DEVELOPMENTS on the PACIFIC COAST"—a regional survey.

NOVEMBER:

"18th EXPOSITION of CHEMICAL INDUSTRIES" issue—featuring Chem & Met's *5th Award For Chemical Engineering Achievement.*

Advertising Forms Close the 25th of the month preceding month of publication.

ABC

CHEMICAL
AND METALLURGICAL
ENGINEERING

ABP

"One of Industry's Great Shopping Centers"

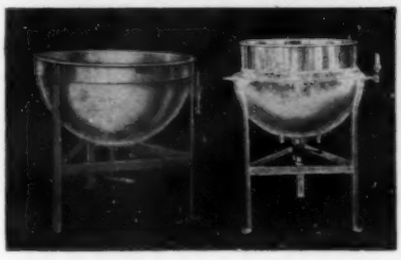
A McGraw-Hill Publication

330 West 42nd Street, New York, N. Y.

LEE

STEAM JACKETED KETTLES

A TYPE and SIZE FOR EVERY FOOD PROCESSING REQUIREMENT



Manufactured by craftsmen with many years of specialized experience in the fabrication of corrosion-resisting vessels of Stainless Steel, Monel Metal and Pure Nickel, Lee Kettles are famous for their immunity to food acids, their brilliant, smooth, easy-to-clean surfaces and their extraordinary toughness and strength. Check your needs from the new 32 page Lee Catalog No. 40. Do you have your copy?

Available in the widest variety of sizes and shapes.

LEE METAL PRODUCTS CO., INC.
412 PINE STREET PHILIPSBURG, PA.

+ FIRST AID TO MEN WHO READ ADVERTISEMENTS +

You read the advertising pages of Chem. & Met. looking for a certain piece of equipment, or perhaps a particular raw material, or data on some cost saving process you've heard about. We imagine you usually find what you want, for our advertising section is a representative one; but, if it isn't advertised in Chem. & Met. we will be glad to have you write us for what-and-where-to-buy information.

PROFESSIONAL SERVICES

Plant Design • General Consulting • Testing • Patents • Research • Management

Chemical, Bacteriological and Nutritional Analysis

CARL DEMRICK
Technical Translations
Send for Circular
525 West 238th St., New York, N. Y.

C. L. MANTELL
Consulting Chemical Engineer
Process Research and Engineering Development
136 Liberty St. New York, N. Y.

STONE & WEBSTER ENGINEERING CORPORATION
Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering
BOSTON • NEW YORK • CHICAGO
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

ELECTRICAL TESTING LABORATORIES
Tests
East End Ave. at 79 St.
NEW YORK, N. Y.

SAMUEL P. SADTLER & SON, INC.
CONSULTING & ANALYTICAL CHEMISTS
CHEMICAL ENGINEERS
Established 1891
210-S 13th St., Philadelphia, Pa.
"Nothing Pays Like Research"

DR. HANS TIEDEMANN
Consulting Engineer
13 A Reinanzaka
Akasaka-ku, Tokyo
Cable Address: Tiedemann Tokyo

NELSON LITTELL
U. S. and Foreign Patents
Infringement and validity opinions
Patent and Trademark Litigations
22 E. 40th St., New York

FOSTER D. SNELL, INC.
Our staff of chemists, engineers and bacteriologists with laboratories for analysis, research, physical testing and bacteriology are prepared to render you
Every Form of Chemical Service
309 Washington Street Brooklyn, N. Y.

THE J. G. WHITE ENGINEERING CORPORATION
Engineers-Constructors
Design and Construction of Chemical Plants, Oil Refineries and Pipe Lines, Pumping and Compressor Stations.
REPORTS and APPRAISALS
80 Broad Street New York

WHERE TO BUY

Featuring additional Equipment Materials and Supplies for the Process Industries

WYCKOFF REDWOOD PIPE

Clear California Redwood pipe has greater carrying capacity than metal or concrete pipe. Does not clog, scale or pit. Light weight. Easily installed. Not affected by electrolysis, worms, frosts and resists heat. Use it for sewage, liquors, acids, water, heavy fluids containing grit—for flumes, fume ducts, etc. Sizes 1" and up. Pressures at 172 lbs. We also manufacture Redwood Underground Steam Pipe Castings. Lengths up to 12 ft.

A. WYCKOFF & SON CO.

OFFICE & FACTORY—12 HOME ST., ELMIRA, N.Y.

Originators of Machine Made Wood Pipe

1855—Our *Eighty-Fifth Anniversary*—1940

COPPER · ALUMINUM · STAINLESS STEEL · NICKEL · MONEL

SILVER · BRASS · BRONZE

LEAD · HERCULOY · EVERDUR

ABREAST OF INDUSTRY'S NEEDS

The tremendous changes that have taken place in the chemical industry during the last 38 years, have found CAMDEN COPPER meeting all new demands for equipment fabricated of the metals listed in the surrounding border.

Illustrated is an 8' x 36' long tank used for storing chemicals, the nature of which necessitated the use of ⅜" thick COPPER with silver brazed seams to resist corrosion.

Call on our varied engineering consulting experience to work out **your current problems in equipment built to meet your needs.**

CAMDEN COPPER WORKS INC. CAMDEN NEW JERSEY

LaMOTTE CHEMICAL CONTROL SERVICE

LaMotte Universal pH Outfit

This compact LaMotte Outfit is readily portable, yet it covers a wide pH range. Can be supplied with any 3, 4, 5, 6, 7 or 8 sets of LaMotte Permanent Color Standards and will therefore cover any desired part of pH range, 0.2-13.6. Applicable to all types of research and industrial pH work. Accurate to 0.1 pH. Excellent for use with highly colored or turbid solutions.

Price $35.00 to $60.00 f. o. b. Baltimore, Md.

LaMOTTE CHEMICAL PRODUCTS CO.

Originators of Practical Application of pH Control

Dept. M Towson, Baltimore, Md.

HAMILTON *Steam Jacketed* KETTLES

—all styles, any size—made in Stainless Steel, Pure Nickel, Monel Metal, Copper. Nationally known for their quality of materials, construction and performance. Built by an organization that has made kettles for more than 66 years.

Let us quote and send you bulletin of the size and type kettle and kind of metal you are interested in.

HAMILTON Kettle Works Company

Hamilton, Ohio

SILENT INJECTORS

We guarantee their capacities and that they perform as their name implies. Why hesitate to eliminate the noise of condensing steam, when we guarantee full success.

For information write to

EMIL E. LUNGWITZ

Terrill Road

Plainfield, N. J.

SALT LOSS CAUSES

HEAT FAG

WORKERS WHO *Sweat* NEED *Salt*

• USE MORTON'S SALT TABLETS •

Morton Salt Co., Chicago, Illinois

FEED MATERIAL BY WEIGHT

THE MERRICK FEED-O-WEIGHT

MERRICK SCALE MFG. CO.

PASSAIC, NEW JERSEY

ACID AND ALKALI PROOF LININGS AND MORTARS

•

ACID PROOF CONSTRUCTION

•

THE CEILCOTE CO.

Consulting and Research Engineers

750 ROCKEFELLER BLDG.

CLEVELAND, OHIO

THE Where to Buy Section of Chemical and Metallurgical Engineering supplements other advertising in this issue with these additional announcements of products and services essential to modern plant operation. Make a habit of checking this page each issue.

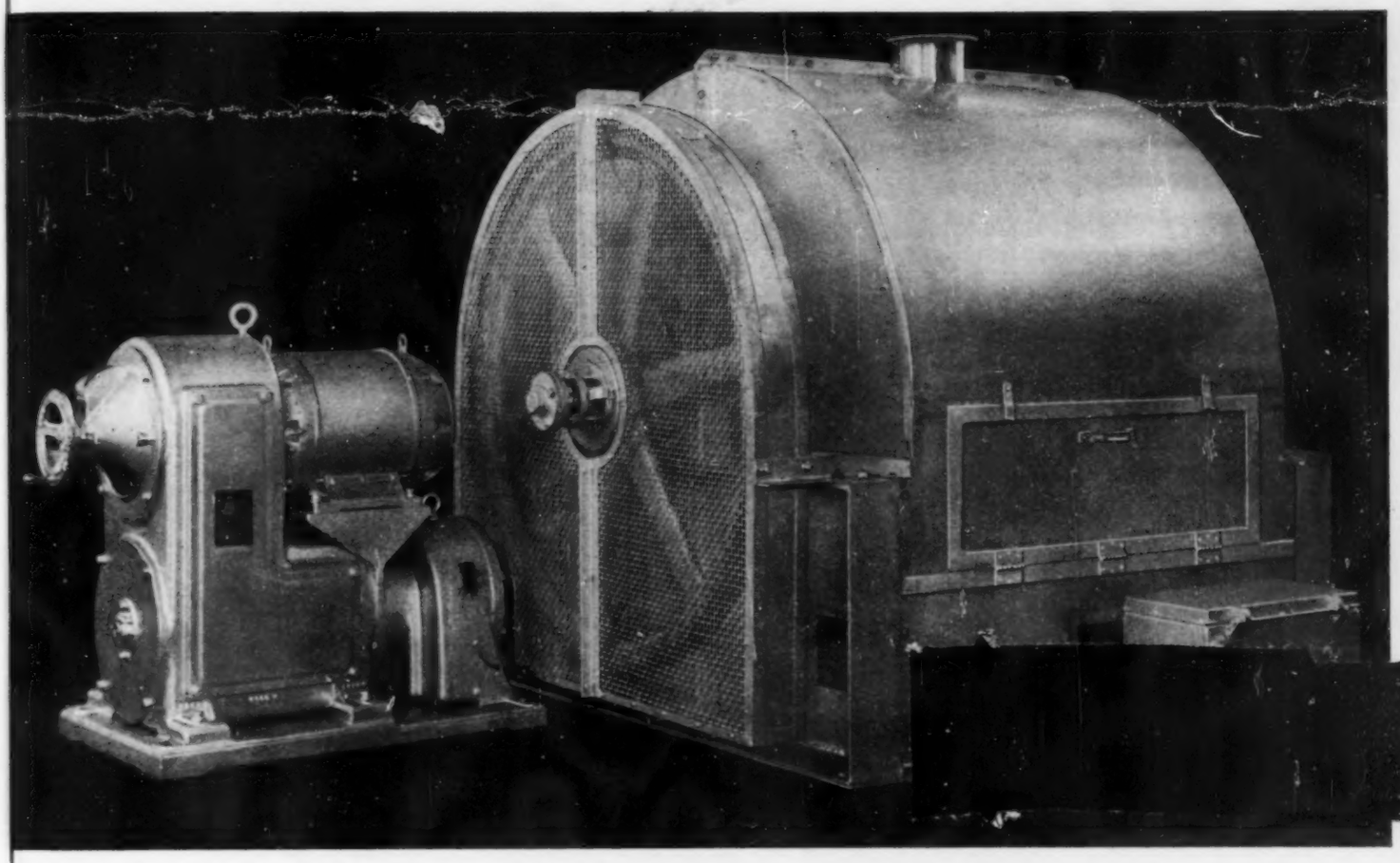
THE PURE OIL CO.

PURE THREE POINT LUBRICATION

A Complete Line of Industrial Petroleum Products

A Pure Oil engineer will help solve your lubrication problems. Write today.

CHICAGO U.S.A.



Buflovak FLAKERS for Cooling and Flaking Chemicals

PROTECTION from dust and toxic hazards is assured by these new BUFLOVAK Enclosed Flakers. Production is increased; power is saved; and knives last longer, as the result of other new features. The adherence of some materials to the drum can be greatly lessened by a device that wets the drum just before it dips into the hot or liquid material.

The illustration shows a BUFLOVAK Enclosed Flaker equipped with automatic liquid feed control and a direct connected motor drive. A variable speed transmission assists in controlling the thickness of the flake and regulating the capacity of the flaker. Stainless steel is used for all parts coming in contact with the material.

Flaking is a continuous process of converting many hot or liquid materials into flake form. The material is applied in a thin layer to a revolving drum on which it cools, solidifies, and is removed in flake form by a stationary knife.

This continuous process economically replaces other forms of solidification . . . Offers increased production at lower cost . . . Time is saved . . . Working space is reduced . . . The necessity of crushing the finished product is avoided.

Although your processing problem may be entirely different, the BUFLOVAK Organization can recommend and build equipment with similar improvements in operating results.

Send for a FREE COPY of the New BUFLOVAK FLAKER BOOK

Here are a few of the latest developments described in the new BUFLOVAK Flaker Book:

Enclosed types, to prevent dust and toxic hazards.

Shielded types, for protection from the material.

Automatic Float Control, for regulating the supply of liquid.

Adjustable Feed Pan.

Wetting Rolls, that lessen adherence of the material to the drum surface.

Uniform Flake Size, controlled by a Material Breaking Device.

Corrosion Resisting Drums.

Variable Speed Transmission.

Self-aligning Roller Bearings.

BUFFALO FOUNDRY & MACHINE CO., 1551 Fillmore Ave., Buffalo, N. Y.

NEW YORK—295 Madison Ave. CHICAGO—1636 Monadnock Bldg. CLEVELAND—726 Keith Bldg. ST. LOUIS—2217 Olive St. OAKLAND, CAL.—1305 Franklin St.

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

UNDISPLAYED RATE:

10 cents a word, minimum charge $2.00.
(See ¶ on box Numbers.)

Positions Wanted (full or part-time salaried employment only), ½ the above rates.

Proposals, 50 cents a line an insertion.

INFORMATION:

Box Numbers in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

Discount of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED—RATE PER INCH:

The advertising rate is $6.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page. C.&M.

POSITIONS VACANT

ASSOCIATE WANTED by Midwest firm of consulting chemists. Young man with training, preferably experience, in design of chemical and processing plant. Moderate investment encouraged. P-99, Chemical & Metallurgical Engineering, 520 N. Michigan Av., Chicago, Ill.

CHEMICAL, METALLURGICAL, or other Engineer with broad training and experience preferably in connection with vacuum tube or allied apparatus. Aptitude and liking for executive work. Good opportunity with old established company. Give full details of experience in reply. P-100, Chemical & Metallurgical Engineering, 520 N. Michigan Ave., Chicago, Ill.

CHIEF DRAFTSMAN:— Permanent position available, should be technical college graduate. Experience should cover supervisory work of draftsmen. Essential also is experience in plant layout, structural, and design of chemical plant equipment. Reply stating age, education, marital status, details of experience and salary required. P-101, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

[redacted]

EXTILE FOREMAN for Viscose Rayon Plant in Brazil. Viscose Spinning, twisting, reeling, coning and winding. In replying give personal data and details of education and experience. Transportation expenses paid to Brazil. Reply to P-105, Chemical & Metallurgical Engineering, 330 W. 42nd St., N. Y. C.

EMPLOYMENT SERVICE

SALARIED POSITIONS, $2,500 to $25,000. This thoroughly organized advertising service of 31 years' recognized standing and reputation carries on preliminary negotiations for positions of the caliber indicated above, through a procedure individualized to each client's personal requirements. Several weeks are required to negotiate and each individual must finance the moderate cost of his own campaign. Retaining fee protected by a refund provision as stipulated in our agreement. Identity is covered and, if employed, present position protected. If your salary has been $2,500 or more, send only name and address for details. R. W. Bixby, Inc., 260 Delward Bldg., Buffalo, N. Y.

Executives and Technical Men. Qualified candidate desiring $2,500 to $20,000 positions may contact employers through our confidential services ,established 25 years. The National Business Bourse, 20 W. Jackson Blvd., Chicago.

POSITIONS WANTED

MECHANICAL ENGINEER. Age 45. Twenty-five years experience, chemical plant layout and process equipment design. A-1 draftsman. designer, checker, estimator, project engineer and supervisor. Licensed professional engineer, New York State. New York City location preferred. PW-93, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

CHEMICAL ENGINEER S.B. 1940, M.I.T. Would like start with chemical or petroleum company. Prefer opportunity in research or development department. PW-92, Chemical and Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

ANALYTICAL CHEMIST. Mature, thoroughly experienced, metals, ores, silicates, fuel, gas, water, soap, alkalies. PW-102, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

CHEMICAL ENGINEER, masters degree, honor society. Production and clerical experience. Desires plant, production, development work. Knowledge of engineering, design, research methods. Advance amateur Photographer. PW-107, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

CHEMIST, recent B. S. wishes to start in any capacity in a chemical industry. Excellent record and references. PW-106, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

REPRESENTATION IN INDIA

An American engineering company with own representative in India handling its equipment and process business is in a position to represent other American companies now doing business in India or seeking to enter this field.

Address RA 95 Chemical & Metallurgical Engineering, 330 W. 42 St., New York City

I Will Buy or Invest In a Business

I will buy or invest in a business doing from $50,000 to $500,000 annually, provided its character is such that I can also invest my interest, enthusiasm and demonstrated knowledge of sales and promotional work.

I am an individual approaching middle age, of independent means, who seeks an absorbing interest as much as a sound, legitimate business. I may find my objective:

(1) In an established business requiring the stimulus of new ideas as well as financial backing: (2) In a new industry past the experimental stage that needs aid to realize its possibilities.

The business should be capable of handling from a Boston headquarters.

BO-94 CHEM & MET
330 W. 42nd St., New York, N. Y.

I Will Buy or Invest

in a small established

Chemical Manufacturing Business or Sales Agency

Interested only in a concern whose affairs will stand detailed investigation

An owner wishing to expand his organization or desiring to retire because of age or ill health will find this an opportunity to deal with a responsible and capable man (43 years of age) having many years of successful experience.

To permit consideration, describe fully the nature of your business and explain clearly the details of proposal.

BO 96, Chemical & Metallurgical Engineering
330 W. 42 St., New York City

POSITIONS WANTED

CHEMICAL ENGINEER B.Ch. E. 1940 Good scholastic record. One year experience electroplating analysis, control and production work. Salary secondary to opportunity. Location immaterial. PW-103, Chemical & Metallurgical Engineering, 330 W. 42nd St., N. Y. C.

CHEMICAL ENGINEER, JUNIOR, B.Ch.E., 1940 Broad engineering and chemical training—theoretical and practical. Mechanical Ability. PW-108, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

PLANT SUPERVISOR, Experienced Chemical Processing, Maintenance, Construction, Power Generation, Milling, Water Purification. 42, Married, Technical Training. Any Location. PW-109, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

MAINTENANCE SUPERINTENDENT, 20 years experience, Chemical Plant Processing, Maintenance, Equipment erection, Power Generation. Technical education, Married, Citizen. Any Location. PW-110, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

POSITIONS WANTED

CHEMICAL ENGINEER, Ch.E. 1922, M. A. 1927. Industrial experience in Research and testing of rubber, textiles and metals. Administrative experience in both teaching and industry. Licensed professional Engineer. American married. Desire permanent position with responsibility. Available immediately. PW-111, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

REPRESENTATIVES AVAILABLE

REPRESENTATION. For Venezuela. Chemicals and Process Machinery. Experienced. References available. A. G. Bulgaris, Chemical Engineer, Apartado 1752, Caracas, Venezuela.

SOUTH AMERICAN EXPORT BUYER, leaving this month for permanent stay South American West Coast buying raw materials for American house. Offer important barter possibilities, also representations, to American Export Concerns. RA-98, Chemical & Metallurgical Engineering, 330 W. 42nd St., N. Y. C.

BUSINESS OPPORTUNITY

Industrial Site For Sale

N. J. Industrial Plant 16000 sq. ft. 4 Concrete and Steel Buildings, 350000 Gal. tankage, Siding, Highway frontage, Transportation, Labor plentiful, Sacrifice, Others; 38,000 and 75,000 Sq. Ft. J. G. Mulford Company, 214 Park Ave., Plainfield, N. J.

WANTED

LITHOPONE expert building of new plant wanted. W-97, Chemical & Metallurgical Engineering, 330 W. 42nd St., New York, N. Y.

WANTED ADVERTISING—PAGE 110

Holiday Greetings

Santa's Gifts from "Consolidated"

IN 4 DIFFERENT WAYS

★ **Best Buys—Low Prices**
★ **Expert Reconditioning**
★ **Absolute Guarantee**
★ **An Experienced Organization**

Typical Consolidated Offerings

3—24" dia. & 1—30" dia. Badger all copper **DISTILLATION UNITS,** complete; Other sizes up to 72".
2—#4 **VALLEZ** Rotary Continuous **FILTERS,** 25 plates, 460 sq. ft.
2—**KELLY FILTERS,** #250 and #450.
6—**OLIVER FILTERS** 3'x2', 6'x4', 6'x6', wood and iron; 8'x8', 8'x12', iron and wood.

SPEED NEEDED!

The liquidation of the CASTALIA PORTLAND CEMENT plant at CASTALIA, OHIO, is nearing a conclusion. These remaining items must be sold immediately. Priced accordingly: **8'x125', 6'x120' and 6'x60' Rotary Kilns.**

3—Direct Heat Rotary Dryers —4'6x50', double shell; 4'x 60', 6'x60'.

2—5'x10' Bonnot Ball Mills, steel lining, with mtrs.

2—5'x22' Tube Mills, silex, with motors.

1—8'x30" Hardinge Conical Ball Mill, iron lined, with motor.

3—5'x27' Tube Mills, silex, with motors.

3—18 ton Steam Locomotives, Vulcan and Porter, 36" ga.

100—1½ yd. two-way Steel Dump Cars, 36" ga.

2500 Horsepower in Electric Motors, all 3/60/440 v., included are 150 H.P.—200 H.P. Slip Ring Motors, 585 RPM.

8—**SWEETLAND FILTERS,** Nos. 12, 11, 10, 9, 7, 5, 2, and laboratory sizes—copper, iron and monel leaves.
1—**SHRIVER** 42"x42" **CAST IRON FILTER PRESS,** plate-frame, 30 chambers; 40 other sizes, wood, lead, bronze.
2—**SHRIVER** 30"x30", centerfeed, recessed, cast iron Filter Presses, 30 plates each.
3—5'x33' **J. P. DEVINE Rotary Vacuum Dryers;** 6—4'x20'.
1—4'6"x20' **LOUISVILLE STEAM TUBE DRYER.**
1—**BLACK & CLAWSON ATMOSPHERIC DOUBLE DRUM DRYER,** 28"x60".
9—**ROTARY DRYERS:** 3'x20', 4'x30', 5'x30', 6'x40', 6'x60', 8'x60', 8'8"x85'.
20—**DEVINE VACUUM SHELF DRYERS,** No. 6, No. 5, No. 1, No. 12, No. 23, No. 26, No. 27, No. 30, No. 32.
1—Devine 52" x 126" **ROTARY VACUUM DRUM DRYER;** 1—Buffalo 48"x40" bronze drums.
1—5'x26' **RUGGLES COLES** Class "A" **ROTARY DRYER.**
1—5'x36' **VULCAN TUBE MILL,** iron lined, 3-compartment, ball charge. Used 3 days.

Remember we buy single items or complete plants

Xmas Stocking "CONSOLIDATED" SPECIALS

★ 1—**HERCULES** 42" Rubber Lined **CENTRIFUGAL EXTRACTOR.**
★ 3—**TOLHURST** 40" suspended **CENTRIFUGALS,** bottom dump, vertical motors.
★ 65—**CENTRIFUGAL MACHINES** from 12 to 72" bronze & steel blankets, belt & motor drive.
★ 10—**W. & P.** jack. and unjack. **MIXERS,** all sizes from 2 to 500 gal.
★ 4—4'x7' **LEAHY VIBRATING SCREENS,** motor driven, double deck, enclosed, rebuilt.
★ 7—**TRAYLOR (JEFFREY) VIBRATING SCREENS,** two 41"x72", five 48"x 84", all double deck. Used 30 days.
★ 1—No. 4 **WILLIAMS "JUMBO" HAMMER MILL.**
★ 6—**RAYMOND PULVERIZERS**—0000, 00, 1 & 3.
★ 2—4 Roll and 5 roll low side **RAYMOND MILLS;** 1—5 Roll high side.
★ 3—**PEBBLE MILLS**—1 Paterson 6'x8' Silex Lined; 1—32"x42" rubber lined.
★ 14—**VIBRATING SCREENS;** 3'x5', 4'x5', 4'x7', Tyler Hummers; 30"x8'6", Robinson; Rotex 20"x48", #41, #52, 4'x8'; Allis-Chalmers 4'x8', 3-deck.
★ 2—5'x22" **HARDINGE CONICAL BALL MILLS.** Also larger sizes.
★ 1—30"x36" **GRUENDLER HAMMER MILL,** #4XC, roller bearings, with new manganese wearing parts.
★ 4—**UNUSED** 4'x8' **KENNEDY COAL PULVERIZERS** inc. motors, fans, burners, etc.
★ 2—No. 4T.H. **MIKRO PULVERIZERS** 24" for direct motor connection; 1-12".
★ 8—9'x160', 8'x150', 8'x125', 6'x120', 6'x60' **ROTARY KILNS.**
★ 1—10' **COPPER JACK. CALANDRIA PAN,** 1200 sq. ft. heating surface.
★ 1—**LUMMUS** 500 gal. **COPPER JACK. VACUUM PAN.**
★ 7—**COPPER JACK. VACUUM PANS,** 50 gal. to 500 gal.
★ 1—**ZAREMBA** 9' dia. triple effect basket type Evaporator, 2100 sq. ft. per effect.
★ 8—**EVAPORATORS** — single, double, triple and quadruple effects, standard makes.
★ 1—20'x20' Vert. **STEEL STORAGE TANK,** 50,000 gal.; 1—20'x17', 31,000 gal.; 3—10'x30', 18,000.
★ 1—**DURIRON** 750 gal. **JACK. KETTLE.**
★ 1—**CAST IRON CLOSED JACKETED AGITATED KETTLE,** lead lined, steel jacket, 4'6" dia. x 6'6" deep, 700 gal.
★ 1—650 gal. **DOPP CAST IRON STEAM JACKETED AGITATED KETTLE;** 1—500 gal.
★ 2—Anco 4'x9' **Cooling Rolls,** complete.

BUY WITH CONFIDENCE

SERVING INDUSTRY 23 YEARS

Did you receive your copy of the Latest Edition of the CONSOLIDATED NEWS listing our complete stock?

Consolidated Products Co., Inc.

15 Park Row, N. Y. C. Shops: 335 Doremus Ave., Newark, N. J.
Tel. BArclay 7-0600 *Every machine in your plant is a used machine* Cable Address: Equipment, N. Y.

SEARCHLIGHT SECTION

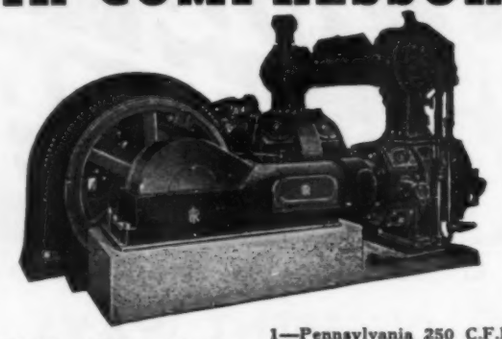
AIR COMPRESSOR
8—Diesel, 105', 315', 420, 603 & 1000 ft.
7—Belted 173', 360', 525', 676', 1000' & 1300'.
9—Elec. 976 ft., 1302 ft., 1570 ft., 2200 & 2850'.
28—Steam 40 ft., 66 ft., 500 ft., 100 & 1300 ft.
75—Low Pressure of all Types.

PLANT EQUIPMENT
Dryers—44"x25 ft., 4x30, 5x60, 6x30.
6—4'x8' Type 39, Hummer Screens.
5 Roll Low Side Raymond Mill.
#0 Raymond Automatic Pulverizer.
R. C. Stanhope, Inc., 60 E. 42nd St., New York, N.Y.

WANTED

WE BUY PLATINUM SCRAP and MERCURY . . . . . IN ANY FORM!
Our policy is to pay highest market prices . . . also to make prompt returns and hold goods for your approval.
Smelters I. MILLER, INC. Refiners
304 Colonial Arcade Cleveland, Ohio

AIR COMPRESSORS



1—Ingersoll Rand 900 C.F.M. with 200 H.P. synchronous motor, Type XRE
1—Ingersoll Rand 1190 C.F.M.
2—Ingersoll Rand 327 C.F.M.
1—Sullivan 1094 C.F.M. WJ3
1—Pennsylvania 250 C.F.M. with 75 H.P. synchronous motor. (180 C.F.M., actual delivery 400 lbs. Pressure, stroke 10 inches.)
1—Chicago Pneumatic, 1055 C.F.M.
1—Bury 546 C.F.M.

LOUIS E. EMERMAN & CO.
1763 ELSTON AVE. CHICAGO

WANTED
Kettle, with Vacuum Equipment and Pump. Complete unit preferred but any part acceptable. Kettle 500-600 gallons capacity. Low pressure. Aluminum, nickel or stainless steel preferred—others considered.
W-168, Chemical & Metallurgical Engrg.
330 West 42nd St., New York City

FOR SALE
TANKS
Two Horizontal Cylindrical Tanks 6 ft. dia. x 60 ft. long. Flanged removable covers both ends.
Write for specifications.
The VULCAN DETINNING CO., Sewaren, N. J.

FOR IMMEDIATE SALE
MAGNETIC SEPARATOR
(1) Latest I-R type Dings Magnetic Separator; 3—10" rools complete with generator and panel equipment.
ILMENITE
Approximately 500 Tons of Ilmenite. Wire or write
Consolidated Operations Corporation
516 Atlantic Nat'l Bank Bldg., Jacksonville, Fla.

WANTED
PAPER DRYER OR COMPLETE COATING MACHINE
Used paper dryer or complete paper coating machine suitable for use in pyroxylin or similar coating on paper. Width up to 54". Write full details.
P. O. Box 270, Morristown, N. J.

FOR SALE
6—**Pony Mixers**
2—12x30" **3-roller Paint Mills**
1—20" **Flat Stone Mill**
1—18" **Twin Iron Mills**
FS-71, Chemical & Metallurgical Engrg.
330 W. 42nd St., New York City

FOR SALE
IMPACT PULVERIZER
1—#1 Raymond **Impact Pulverizer** complete with #11 exhauster fan, separator, cyclone collector.
Good Condition
Price — $1,000.00
FS-113, Chemical & Metallurgical Engrg.
330 W. 42nd St., New York City

Mr. Reader:

Can You Shout Loud Enough To Be Heard From Maine To California?

Sure, it's a silly question — 'cause everybody knows you can't—that is, without other aid. We used it merely to give point and emphasis to the fact that this page can carry a message for you not only that far, but farther. Through an advertisement on this page you can contact men from Maine to California, from Florida to Washington, and all points in between.

Your advertisement on this page will go before that special group of men who—like yourself—have a business interest in the operating, technical and business problems of the Chemical and Process industries. These men are the over 16,000 subscribers who read "Chem & Met" for news of everything pertinent to their profession.

You can whisper or shout your message—in type—to these other readers. Small Want-type ads cost only a dime a word or you can "shout" your message in prominent type—in individual space—at the rates quoted in the Searchlight heading.

It has been "Chem & Met's" privilege to serve hundreds of advertisers through its Searchlight Section. By far the greater part of these advertisers have been *readers* of "Chem & Met" who recognize that *other* readers were most likely to be interested in or to respond to their offerings or wants.

If you have Employment, Equipment or Business Opportunities to offer for the attention of other readers of "Chem & Met" your advertisement in this Section will come to their attention wherever they may be located.

Departmental Advertising Staff—"CHEM. & MET."—330 W. 42nd St., New York

4—Patterson Silex Lined Pebble Mills, approx. 7' dia. x 5' face.

2—Sweetland Filters, #7 & #10.
1—Bauer 22" Attrition Mill.
1—Tyler Hummer Screen, 4'x5', motor driven.
1—Gordon Davis 2 Truck Dryer.
1—Devine #27 Vacuum Dryer, 17 shelves.
1—Proctor & Schwartz 11 Unit Tunnel Dryer, 52 trucks.
1—Oliver 3'x½' Lab. Rotary Filter.
2—Anderson Oil Expellers, motor driven.
1—500 Gal. Closed Agit. Jack. Steel Kettle.
1—900 Gal. Closed Agit. Jack. Steel Kettle.
3—#00, #0 and #1 Raymond Mills.
1—Devine #30 Vacuum Dryer, 13 shelves.
6—Pfaudler 300 & 500 gal. Jack. Glass Lined Kettles.
1—Huhn 3'x8' Rotary Steam Tube Dryer.
18—Pfaudler Glass Lined Tanks and Kettles.
2—40 Gal. Alum. Jack. Welded Kettles.
4—Williams Ball Bearing Hammer Mills.
4—Day 400 to 3000 lbs. Powder Mixers.
12—Iron & Wood Filter Presses, 12" to 48".
10—Abbe Pebble Mills, Lab. to 750 Gal.
1—#700 DeLaval Centrifuge, motor driven.
1—Tolhurst 32" Centrifugal Copper Basket.
1—Gruendler 50 H.P. Hammer Mill.
1—Stedman 42" Ball Bear. Disintegrator.
10—Closed Agit. Jack. Kettles, 250 to 1000 Gals.
4—Ross 3 Roller Mills, 9"x24", 12"x30", and 16"x40".
6—Horiz. Jack. & Unjack. Mixers, Lab. to 300 Gal.

Specialists in Hydraulic Presses, Pumps, and Accumulators. Only partial listing.
Send for Chem. Bulletin No. 128 and Hydr. No. 156
We Buy Your Surplus Machinery For Cash.

STEIN EQUIPMENT CORP.

426 Broome St., New York City
Phone: CAnal 6-8147

6'x12' Hardinge Rod Mill
Proctor 2 Truck Dryer
150 gallon Jacketed W & P Mixer
5'x12' Stokes Drum Dryer
6' 8"x8' Silex Lined Pebble Mill

LAWLER COMPANY
Metuchen, N. J.

FOR SALE

250 gal. Stainless Steel Tank, jkt., agit.
1500 to 3000 gal. Stainless Steel Tanks.
2000 Aluminum Truck Tank.
275 gal. Pfaudler Tank, jkt., agit. 48x36.
330 gal. Pfaudler Tank, jkt., agit., 45x48.
450 gal. Pfaudler Jacketed Tank, 54x48.
10 H.P. Tubeless Boiler & Oil Burner.
48" Tolhurst Centrifugal, copper basket.
33" Devine Deodorizing Column.
24" Sperry S.S. Filter Press, 13 chambers.
36" Shriver Filter Press, 18 chambers.
No. 11 Devine Vacuum Dryer, 17 shelves.
24"x36" Double Drum Dryer.
60 to 1000 gal. Homogenizers or Viscolizers.
2" Stainless Steel Centrifugal Pump, 5 H.P.
3 ft. to 7 ft. Copper Vacuum Pans.
3 ft. Badger Copper Vacuum Pan, agit.

What Have You For Sale?
Send Us Your Inquiries

ROBERT P. KEHOE MACHINERY COMPANY
1 East 42nd Street, New York, N. Y.

NEW "SEARCHLIGHT" Advertisements

must be received by January 6th to appear in the January issue.

Address copy to the Departmental Advertising Staff

Chemical & Metallurgical Engineering
330 West 42d St., New York City

GUARANTEED
NEW AND REBUILT EQUIPMENT
FOR THE CHEMICAL AND PROCESS INDUSTRIES

IT'S INVENTORY TIME!

You have just taken Inventory or you are about to have it taken. What about EQUIPMENT?

Dispose of your surplus units. Turn them into cash . . give your plant more working space as well. Idle, obsolete machinery proves costly in many ways. FMC will pay good prices for your surplus equipment.

What do you need in processing apparatus? Perhaps our stock will yield just the machine NOW . . . . whereas most new equipment manufacturers are weeks behind in delivery. You save HALF too.

Do you need a machine for a particular process? Our technicians may suggest (from experience) something that has not occurred to you. FMC engineers are at your service.

Send for Catalog or House Organ.

FIRST MACHINERY CORP.

FMC

9th St. & EAST RIVER DRIVE
NEW YORK CITY

FOR SALE

3—12" Mikro Pulverizers
2—150 gal. W. & P. Mixers.
2—100 gal. W. & P. Mixers.
4—40" suspended type Centrifugals.
2—Raymond Screen Hammer Mills.
1—Devine 4x15' rotary Vacuum Dryer.
2—DeLaval #600 Clarifiers.
1—Louisville steam tube Dryer.
6—Direct heat Dryers—3x30 to 8x70'.
3—#10 and #20 Day Imperial Mixers.
1—28" style F Schutz-O'Neill Pulverizer.
12—Filter Presses—12" 18", 24" and 30".
1—#5 Sweetland Filter.
1—Devine Vacuum Chamber Dryer #23.
3—Kinney 8x8x12" Vacuum Pumps.
5—Evaporators & Vacuum Pans.
1—4x9' Atmospheric Drum Dryer.
2—Abbe Pebble Mills 45"x42" face.

Send us a list of your idle equipment.

LOEB EQUIPMENT SUPPLY CO.
908 N. Marshfield Ave. Chicago, Ill.

USED STEAM JACKETED COPPER KETTLES
5 gal. to 100 gal.

2 CANDY COOLING SLABS

BRIGHTON COPPER WORKS
Brighton Station Cincinnati, Ohio

1—4'6"x3'6" PATTERSON JACKETED MANGANESE LINED BALL MILL, PRACTICALLY NEW

25—Pebble Mills, 10 to 300 Gal.
30—50 to 500 Gal. Copper Jacketed Kettles
15—Pony Mixers, 3, 15 and 40 Gal.
1—36" Shriver Varnish Filter Press
12", 18", 24" and 30" closed delivery Filter Presses
Iron, Copper, Glass Lined Tanks, jacketed
28" and 48" Stedman Disintegrators
3—Karl Kolfer Varvisco Fillers
3—O & J Rotary Labellers
5—Motor driven Star Feeders
NEW PORTABLE MIXERS, std. and ex. proof, ¼ to 10 HP
NEW STAINLESS STEEL TANKS, built to order

We Will Purchase Your Surplus Equipment

MARTYN PEREZ

Third and Wood Sts. Philadelphia, Pa.

REBUILT MACHINERY

PULVERIZERS — GRINDERS

6—Raymond #0000, #00, #1, 3 roll, 4 roll
10—Williams, Jaybee, Gruendler, Hammer Mills
15—Pebble & Ball Mills, from Lab. to 1000 gal.
1—Patterson 6x8 Ball Mill
5—Day, Ross, 2 roller Mills, 12"x30", 16"x40"
6—Colloid Mills, U. S. and Premier
4—Hardinge Mills 4½'x16" to 8'x30"

DRYERS — KILNS

3—Devine, Buffalo Vac Drum 24"x20", 48"x40", 40"x60"
4—Stokes, Devine & Buffalo Atmos. Drum 3'x6', 4'x9', 5'x12'.
4—Stokes Devine Rotary Vac. 2'x8', 3'x15', 4'x20'
5—Rotary Type, 3'x10' to 6'x60', direct and indirect.
5—Devine, Buffalo and Stokes, Vac. Shelf.
5—Rotary Kilns 6'x60' to 9'x150'
2—Louisville Steam Tube Dryers

STILLS — EVAPORATORS — PANS

2—Pfaudler 100, 500 gal.
6—Swenson, Garrigue, Zaremba, Single and Multiple effect Evaporators
1—Ananola 200 gal. Copper Steel and Condenser
3—Copper Vacuum Pans, 60 to 400 gals.
2—C.I. Coil Vacuum Pans, 7', 10'

KETTLES — AUTOCLAVES — TANKS

5—Burkhardt 50 to 125 gal. Copper Jacketed Agitated Kettles
5—Rubber Lined Tanks 300 to 1500 gals.
12—Glass Lined Storage Tanks, 50 to 500 gals.
5—Valley Iron, Autoclaves, direct fired and jacketed, agitated, 10, 150, 250, 750 gal.
1—500 gal. jacketed, agitated, glass lined
3—Day Howard 500 gal. jacketed, agitated steel
25—Copper, steam jacketed, 10 to 300 gal.
4—Aluminum jacketed 40 to 150 gal.

FILTERS

1—Shriver 30" Steam Jacketed Cast Iron
19—Shriver and Sperry 12" to 36" cast iron
12—Shriver 18" to 36" wood
3—Oliver 5'4"x4', 6'x4', 8'x12'
5—Sweetland, #5, #7, #10, #12
4—Kelly, #150, #450, #900

CENTRIFUGALS

1—Tolhurst 10"—rubber lined
3—Fletcher & Tolhurst 32", 40" bottom discharge
1—Tolhurst 48" Rubber Lined, motor driven
2—Tolhurst 48" stainless steel & monel baskets
3—Sharples & De Laval Centrifuges

MIXERS

1—Day Jumbo Jacketed Mixer, 680 gallons
5—Patterson 1000 to 1200 gal. Vertical Mixing Tanks
10—200 to 3000 lb. Dry Powder Mixers
20—Portable Agitators, ¼ to 2 HP
5—W & P, Day, 5 to 150 gal. Double Arm Mixers, jacketed & unjacketed

MISCELLANEOUS

Tablet Machines, Screens, Pumps, Conveyors, Packaging Equipment, etc.

LIQUIDATING

MAXWELL SUGAR COMPANY
Send for Complete Bulletin
Main Items—

4—36" Plate and Frame Filter Presses
3—36" AT & M Centrifugals
6—"U" Crystallizers, 350 cu. ft.
1—Triple Effect Evaporator, 3500 sq. ft.
2—Vacuum Pans, 7', 10' dia.
1—Hersey Granulator, 5x23.
Miscellaneous Tanks, Pumps, Beet Sugar Equipment, etc.

Special Bulletins on request for Chemical, Paper Mill, Paint, Pharmaceutical, Soap and Food Machinery and Equipment

BRILL EQUIPMENT CORP.
183 VARICK ST
NEW YORK, N. Y.

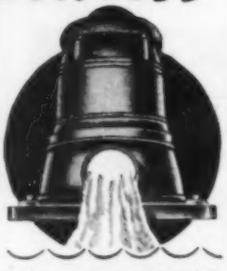
VACUUM PUMP

Worthington Feather Valve Dry Vacuum Pump, straight line cylinder sizes 18"x12", Displacement 700 CFM 28" of Vacuum, silent chain drive, with 40 H.P. Westinghouse A.C. Motor.

EXCELLENT CONDITION

DENNY & CLARK
910 North Marshfield Ave. CHICAGO, ILL.

IF YOU *Believe In Preparedness*



—Remember that water has always been, is now, and forever will be one of your most vital needs. It is an absolute necessity for MEN, MACHINERY AND MATERIALS. Your present water supply may not be adequate for expansion—or emergency. It may be costing you too much. It may need enlarging.

Now is the time to practice preparedness. Without delay you may secure the cooperation of Layne Engineers who will check your present water supply and offer valuable recommendations on increasing volume or the lowering of operation cost. Behind these Engineers stand the world's foremost water developers; an organization equipped and capable of making dependable preliminary investigations, reconditioning old wells, drilling new ones, furnishing and setting pumps for a complete Well Water Supply System.

If you want facts about Layne Well Water Supply Systems, Layne Vertical Turbine Pumps, etc., with views and details about worldwide installations, write for illustrated literature. Address,

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LAYNE-BOWLER NEW ENGLAND COMPANY, BOSTON . . . . . MASSACHUSETTS.
INTERNATIONAL WATER SUPPLY, LTD., LONDON . . . . . ONTARIO, CANADA

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Dept. T-3, Memphis, Tenn.

LAYNE

PUMPS & WELL WATER SYSTEMS

For Municipalities, Industries, Railroads, Mines and Irrigation

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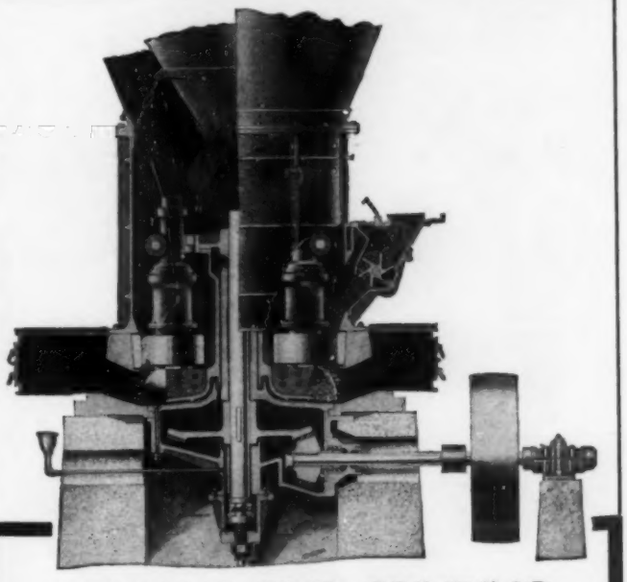
DRYING AND GRINDING IN ONE OPERATION

WITH

LOWER POWER CONSUMPTION AND MAINTENANCE



WILLIAMS FINE GRINDING and AIR SEPARATING EQUIPMENT

From the standpoint of economy and correct processing, drying and grinding are now logically ONE OPERATION. By combining these operations you effect a saving not only in the high purchase price and installation expense of separate drying equipment, but also in the final cost per ton of material handled.

The Williams Dryer Mill converts wet solids containing 3% to 50% of moisture into finely pulverized powders of 100 to 325 mesh fineness. Consists of the well known Williams Roller Mill and Air Separator connected to a heating unit which supplies the hot air for drying. Built in nine standard sizes—write today for information.

THE WILLIAMS PATENT CRUSHER AND PULVERIZER CO.
2706 North Ninth St. St. Louis, Mo.

Sales Agencies Include

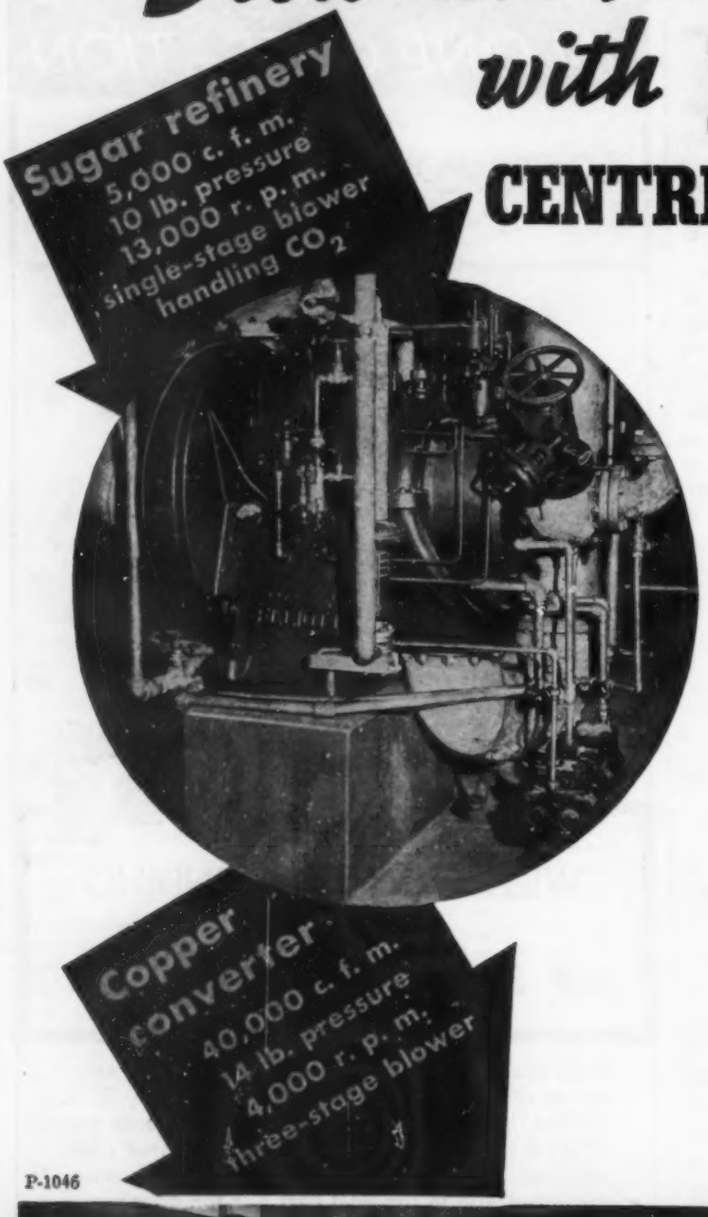
CHICAGO 37 W. VanBuren St. | NEW YORK 15 Park Row | OAKLAND, CALIF. 1629 Telegraph Ave.

OLDEST AND LARGEST BUILDERS OF HAMMERMILLS IN THE WORLD

Williams

PATENT CRUSHERS GRINDERS SHREDDERS

Blow air, move gases with ELLIOTT CENTRIFUGAL BLOWERS



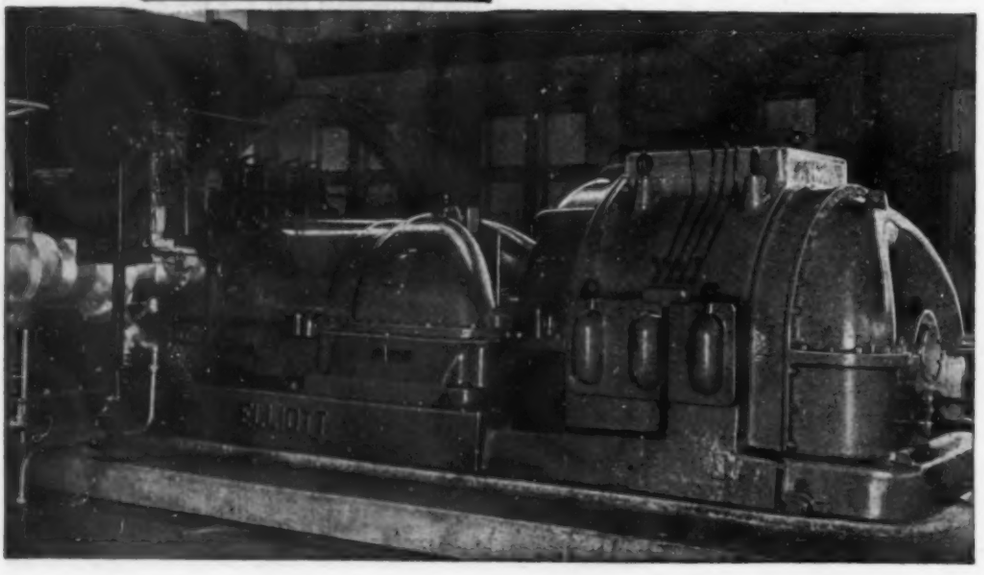
P-1046

From small, compact, high-speed single-stage centrifugal blowers to large, highly efficient, multi-stage units, there is a range of performance which fits Elliott Blowers into a large field of applications in the chemical and process industries.

Elliott designs and builds the blower; the driver, whether turbine or motor; speed-increasing gears, where required; condenser for the turbine, etc.

Consult an Elliott engineer-salesman . . .

He may have a valuable application idea which you can use without obligation.

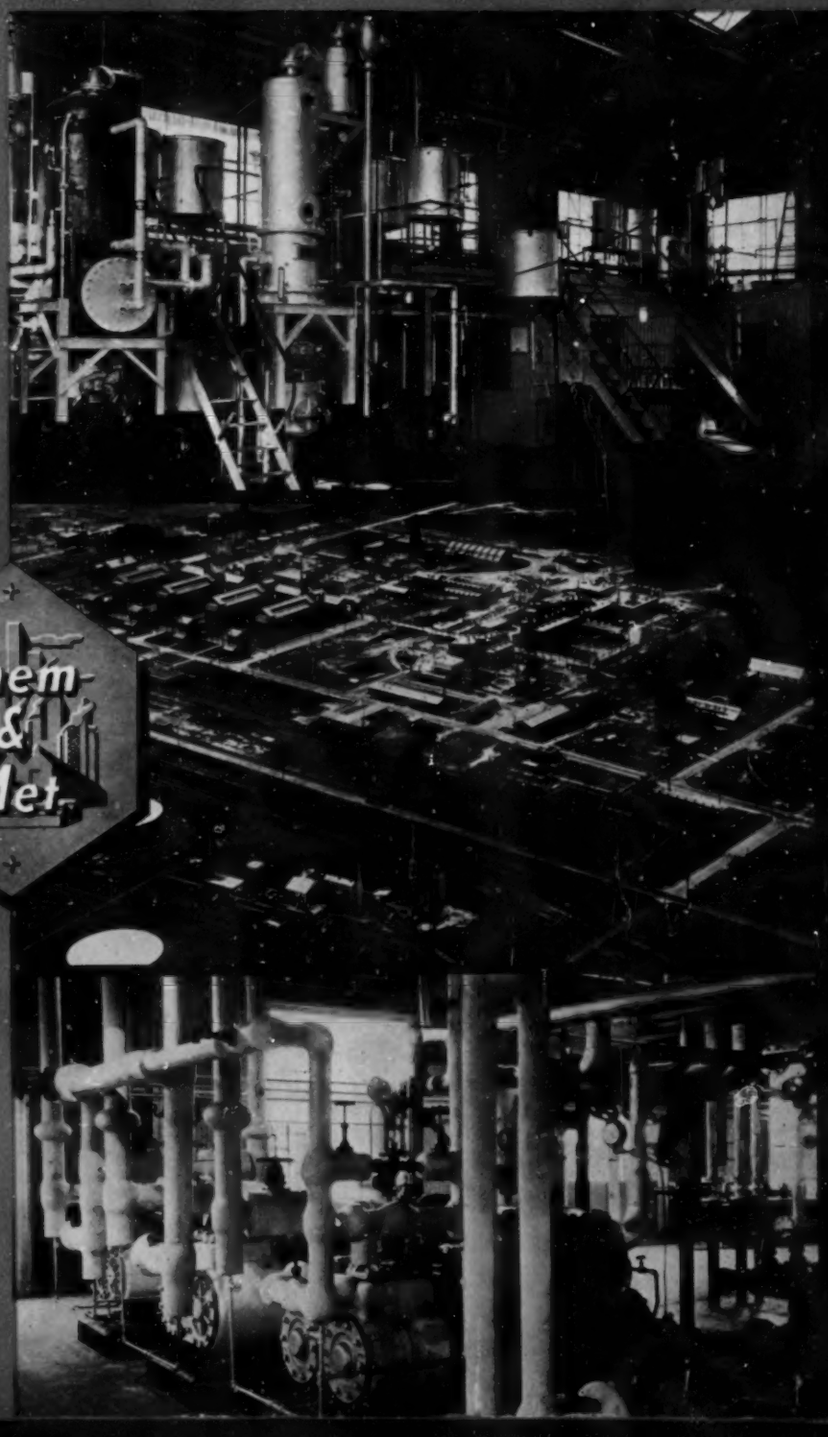


ELLIOTT COMPANY

Centrifugal Blower Dept.
JEANNETTE, PA.

District Offices in Principal Cities

CHEMICAL & METALLURGICAL ENGINEERING



DECEMBER, 1940

SYNTHETIC GLYCERINE FROM PETROLEUM

Glycerine not only can be but is made from petroleum today. Important as this announcement would be in peacetime, it is doubly important in time of war. Shell chemical engineers tell of the development of their unique process on pages 834 to 838.

SOUTHWARD GO THE CHEMICAL PROCESS INDUSTRIES

Irrespective of what was said by both sides in the recent presidential campaign, the migration of the process industries to the Deep South is a natural development. The outstanding new plants along the Gulf Coast are seen on an imaginary trip from Corpus Christi, Texas, to Mobile, Ala., appearing on pages 826 to 829.

SOLVENT REFINING AS APPLIED TO LUBRICATING OILS

Petroleum refining is pushing ahead at an almost unbelievable rate. Furfural refining was discovered by Shell Oil Co. and developed commercially by the Texas Co. For an illustrated flowsheet of the process in use at the Port Arthur refinery see pages 859 to 862.

COMPLETE CONTENTS, Page

One of a number of Link-Belt TWIST-Type Silverlink Roller Chain drives in a western mill. The unique construction of this chain provides freedom for axial twist, yet maintains complete bearing for the pin in the direction in which it is required to carry its normal load. This feature compensates for changes in alignment of the drive.

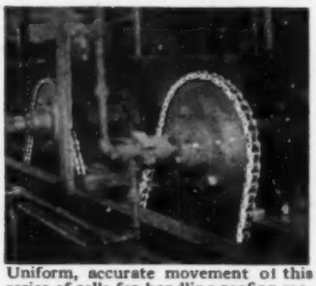
• Design and mill engineers alike recognize the value of Silverlink's accurately finished, all-steel construction, built to the highest standards of precision . . . that it combines great strength with comparatively light weight . . . that it is extremely flexible, assures smooth operation, and is especially capable of withstanding severe shocks . . . that it minimizes wear and repair. They recognize, too, the value of Link-Belt engineering service in working out problems in connection with the use of roller chains for conveying and power transmitting.

Complete drives—chains and sprockets—from ¼ to 225 H.P., in speed ratios 1:1 up to 8:1 are stocked by distributors throughout the country. Send for Stock List No. 1557.

LINK-BELT COMPANY

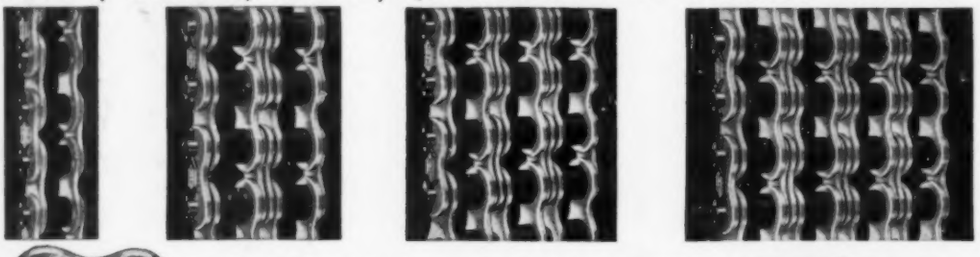
The Leading Manufacturer of Positive Power Transmitting Equipment
INDIANAPOLIS CHICAGO PHILADELPHIA ATLANTA DALLAS
SAN FRANCISCO TORONTO
Branch offices, warehouses and distributors in principal cities. 8273-G

Handling bottles is typical of the many ways in which Silverlink roller chains with various attachments, speed the handling of small units, cans, jars, glassware, boxes, etc.



Uniform, accurate movement of this series of rolls for handling roofing material were requirements here—Link-Belt Silverlink Roller Chain being the ideal solution for efficient performance and low maintenance.

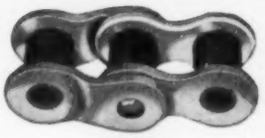
SINGLE, DOUBLE, TRIPLE, QUADRUPLE AND GREATER WIDTHS—



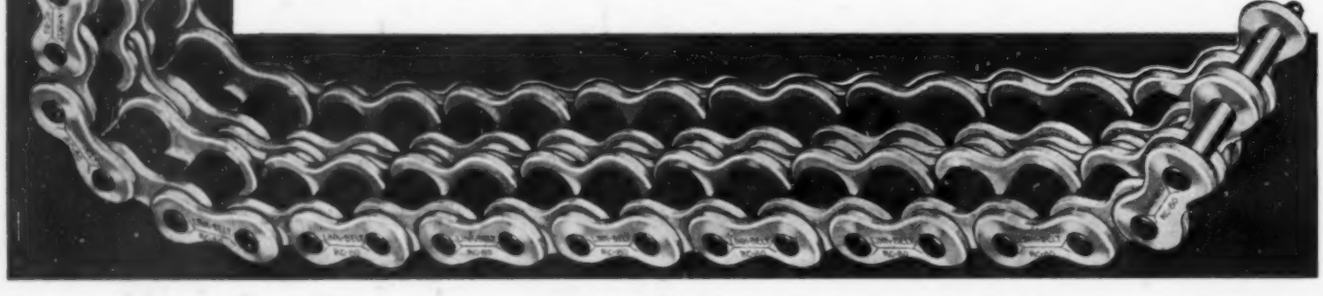
Connecting (Tight-Fit) Link and Coupler (Slip-Fit) Link.

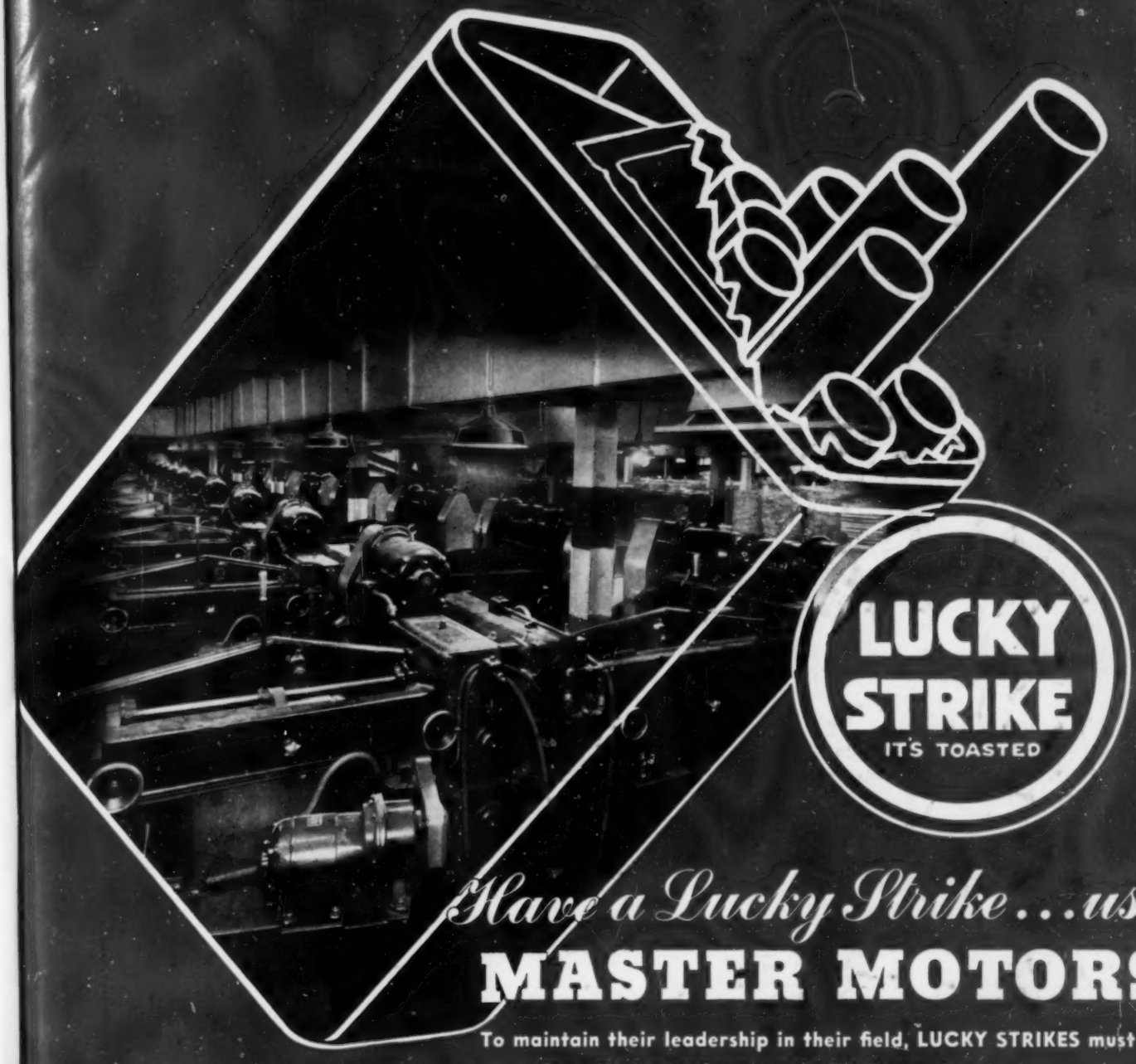
CONNECTING AND COUPLER LINKS

Connecting and coupler links, 1 and 2-pitch offset links, and roller links can be furnished to fit all types of single and multiple width roller chains. Available in detachable cotter pin, spring clip, or riveted type, depending upon the size of chain and service requirements.



2-Pitch Offset Link





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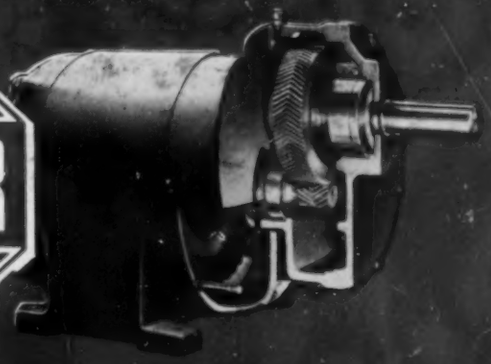
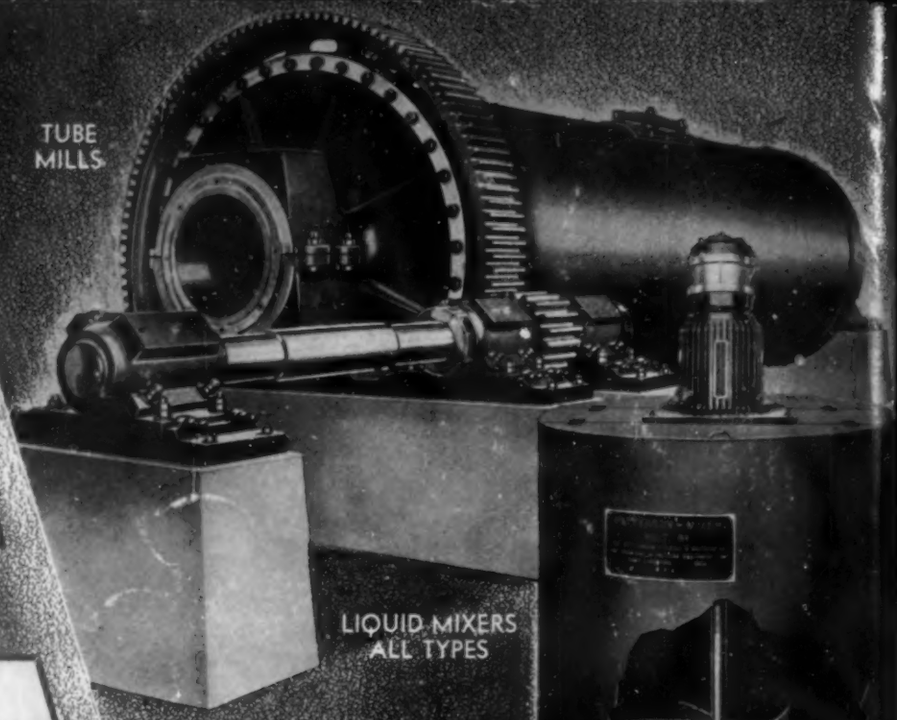


PATTERSON

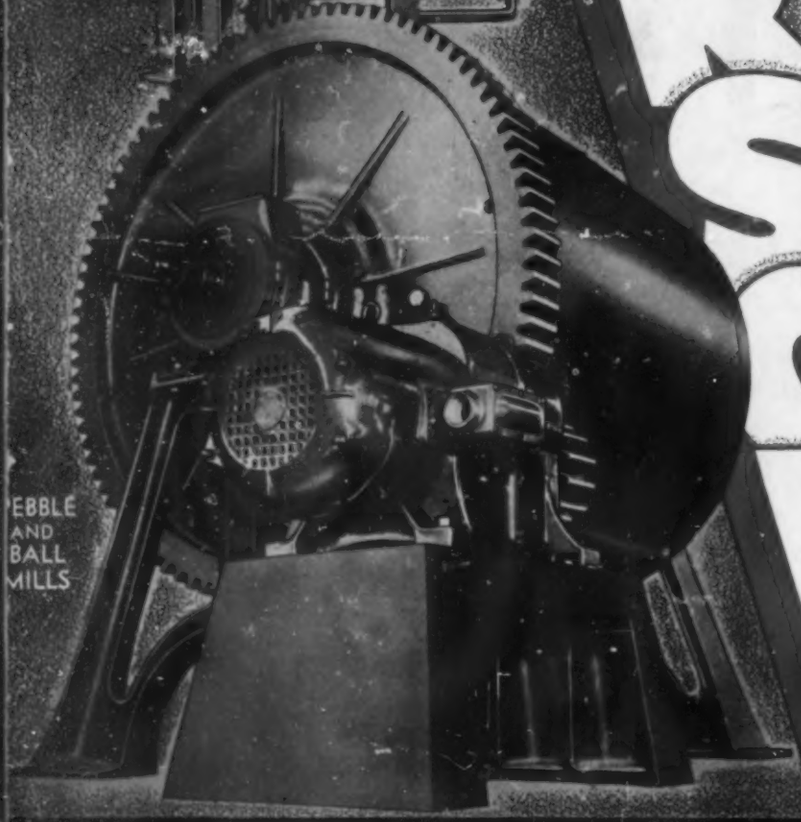


TUBE MILLS

KETTLES ELECTRIC AND JACKETED

LIQUID MIXERS ALL TYPES

KNEADERS



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